APRIL 1952

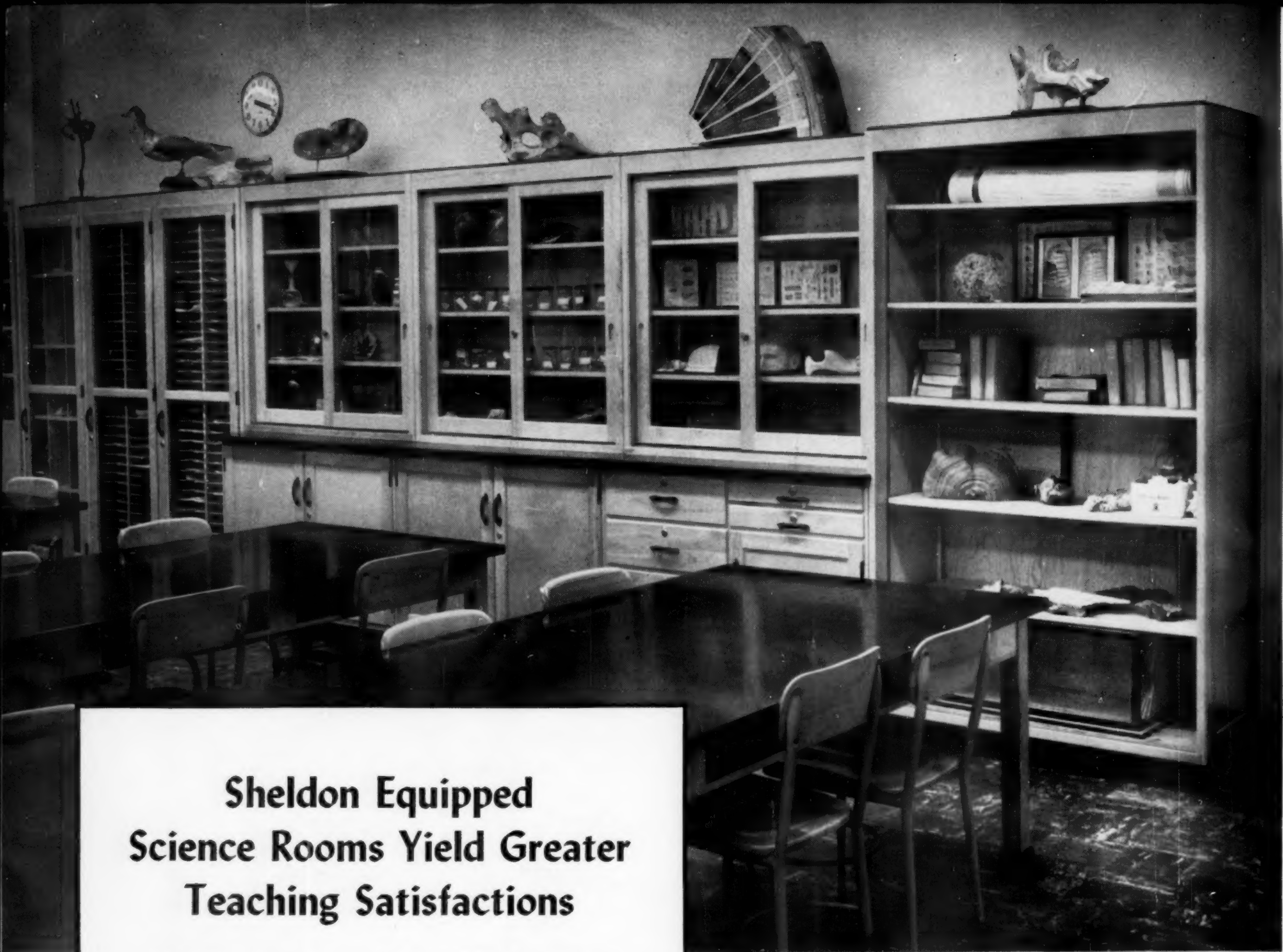
THE SCIENCE TEACHER

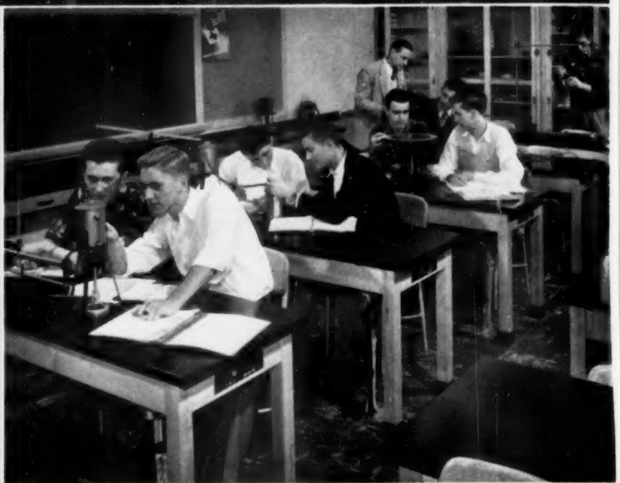
1952 ANNUAL SUMMER CONFERENCE

University of Michigan
June 26-28

- The College Board's Science Tests
- The Science Teacher's Objectives and Their Sources
- The Problem of Supplies for Elementary Science
- Science in the Service of Youth's Interests
- Science in American History

JOURNAL OF THE NATIONAL SCIENCE TEACHERS ASSOCIATION





This MONTH'S COVER . . . is a picture of the Rackham Building on the campus of the University of Michigan. This is where the sessions of the Annual Summer Conference of NSTA will be held June 26-28. It is expected, too, that the exhibit of science teaching materials will be housed in the Rackham Building.

Guided Missives

I am now in the service, and as much as I found the packets and magazine invigorating and stimulating I cannot continue to be a member—the only reason being that I can't afford it. Upon reaching civilian status again, I will become an active member again.

You may be interested in knowing that I am going to an army service school. Here they disregard democratic classroom procedure. It's entirely too rigid, and it actually makes me angry to see all modern teaching techniques overlooked. They realize it, and the time element is given as an excuse.

FORMER SCIENCE TEACHER

Dr. Subarsky's article on "Literature as Science Experience" in the February, 1952, issue of *The Science Teacher*, which in its new format and careful editorial styling is reviving science as literature, goes a long way toward pointing a new and positive direction in science teaching. As Dr. Conant of Harvard and others have pointed out, this method bridges the gap between science and literature, between technology and the humanities.

It further emphasizes the point that for practical success and advancement in scientific and engineering fields, the ability to express oneself clearly and succinctly on paper is often a major factor. The "one page" report is everywhere desired. It has been pointed out that Lt. Col. Eisenhower's ability to outline the conduct of a global war in 30 pages was the key point in the later career of General Dwight Eisenhower.

Holding up fine models of writing by scientists themselves is an excellent way of encouraging science students to find means of expressing themselves effectively. Several excellent anthologies of this sort are available; among them, *A Treasury of Science* (Harpers, 1943); *The Autobiography of Science* (Doubleday, 1945); *Through Engineering Eyes* (Pitman, 1941).

JUSTUS J. SCHIFFERES
New York City

THE SCIENCE TEACHER

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THE SCIENCE TEACHER

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The National Science Teachers Association is a Department of the National Education Association and an Affiliate of the American Association for the Advancement of Science. Established in 1895 as the NEA Department of Science Instruction, the Association later became the American Council of Science Teachers. It merged with the American Science Teachers Association and reorganized in 1944 to form the present Association, and **The Science Teacher** became the Official Journal of the new National Science Teachers Association.

The College Board's Science Tests

By PAUL F. BRANDWEIN

If by some improbable chance you and I were given the power to dictate the course of education, what would we do about education in the sciences? If only we could call upon a formula to help us, such as $E = mc^2$, where E = education, m = materials of instruction, and c = a constant based on speed of learning, our burden would be considerably lightened. But science education, like all education, is not a science; it has only just begun to travel the rigorous and tedious road toward validity. There is cause for satisfaction as we see places where magic, superstition, and authority have been replaced by free-ranging speculation based on experience. Here and there we see experience giving way to experiment, which in a sense is experience in search of meaning. Still, we cannot call upon a formula. Nor can we call upon a body of investigation whose validity is really completely irreproachable.

> Here is an opportunity for science teachers to get in on the ground floor of an impending, significant development. The College Entrance Board has recently appointed a new committee on science testing. The direction of the committee's thinking relative to the development of new tests in science is clearly set forth in this article by Dr. Paul F. Brandwein, a member of the committee. Sample test items are given. The connections between the committee's viewpoint on testing and the philosophy and goals of science teaching are stated or clearly implied.
>
> Classroom teachers will certainly appreciate this advance information on the CEB testing program in science. Moreover, they probably will want to react to the ideas proposed, to send in their own comments and suggestions, their approval or disapproval. The committee will welcome such response.
>
> The author of the article needs no introduction since he is well known to NSTA members and to science teachers generally through his appearances on programs at meetings and conferences, his magazine articles, his textbook work with Harcourt, Brace and Company, and his teaching at Forest Hills, New York, High School and Teachers College, Columbia University.

Can we call upon the wisdom of experienced science educators to help us fashion the curriculum we desire? Of course, but here, too, we gain little comfort; there appears to be the widest disagreement for there is the widest range of experience. Nevertheless, the observer who has an operational approach, that is, who looks for what is being done rather than for what is being said, and who, in addition, looks not for agreement but for direction, will find unmistakable signs of the state of affairs in science education and, indeed, in education generally.

There was a time when most young men and women who went to secondary school also went to college. It seemed clear then that the secondary school's curriculum should be introductory to the college curriculum. In objectives, curriculum, and method the college was the template of the high school. Thus, success in college could often be extrapolated from success in high school. It was reasonable to expect that the efforts of the College Entrance Board in those days would be expended in developing tests to measure success in the subject-matter fields.

A search into the curriculum of the then college-centered high school, if I may use a more appropriate adjective than subject-centered, shows rifts in what would appear on the surface to be a placid curriculum. First, there was the American dream of a free education for everyone; more boys and girls were going to high school, and some of these, for one reason or another, were not going to college. Second, as these students with different needs and interests began to make inroads into the high school population, there was competition for curricular time—new courses began to appear as the established ones began to lose ground. We all may recall the fate of Greek, botany, ancient and medieval history, and other courses.

If we follow one transmutation in subject matter we can sense the direction of the educational wind. What befell botany and zoology? They became general biology. An examination of the curriculum of this early general biology, however, shows that it was one half year of botany and one half year of zoology; only the course title had changed. As teachers asked themselves, "To what end?" and began to change method as well as content, the course began to approach the realities of educational life, that is, it began to meet the needs and interests of most of the students in the schools. To make a long story of educational development short, general biology went the road from a course which sought its mainspring in college preparatory courses (and hence was introductory) to one whose mainspring was in faculty psychology (and hence was valuable for its mental discipline) to one which at present seeks to meet the needs and interests of the students (and hence has its mainspring in the student himself).

Biology Concerned with the Human Being

Even now we shall find all three courses existing, but the last enrolls a great number of students in the public high schools. This last course does not concern itself mainly with the biology of the frog or the garden pea, but of the human being. Its problems are not primarily osmosis, nor the classification of various invertebrates, nor meiosis, nor the fate of the dorsal arch, nor even the cell itself. Its problems are those the students will meet in life, among them, those of nutrition, conservation of natural resources, and individual health. Osmotic pressures or the anatomy of the crayfish or any other subject matter is useful when it helps solve these problems. The modern course in general biology looks primarily not to the development of subject-matter specialists but to the development of citizens whose need is to know the kind of biology which will help them live better lives.

Note, too, if you please, that physics and chemistry are approaching the curricular focus of general biology. Here and there over the country, courses in physical science, embracing physics and chemistry, are springing up. Many of them are just changes in course title. Others are developing as sound general courses in physical science designed to meet the needs of youngsters who will live in a world changed by the physicist and chemist and who will need to understand and profit from these changes as they occur.

Teachers are coming closer and closer to accepting as the aim of the high school the personal and social development of young people. They realize that there is all the difference in the world between teaching subject matter as an end in itself and teaching it to solve problems of living. The criterion for selecting subject matter is becoming: Will this course help young people to meet their developmental tasks, that is, the tasks they must complete to become successful members of a society growing ever more complex?

While courses such as auto driving are at present on the periphery of the central objectives of the school, they gain their sanction from the needs and interests of teen-age drivers whose death toll is increasing. Nevertheless, the process of general education, of which a course in auto driving is the symptom and not necessarily a central objective, has been at work at the core of the high school curriculum.

We need have no anxiety that standards of scholarship or other aims of intellectual aspiration will suffer. Children who have not had Greek but have had modern languages, who have not had the traditional courses in history but have had social studies or problems of civilization, who have not had botany, zoology, physics, and chemistry but have had general science, biological science, and physical science have shown themselves able to profit from college and community life and to contribute to both. The lessons of the Eight Year Study, crude as they were, need not be lost on us. Indeed, in my own "experientation," to use an awkward although more appropriate substitute for the word experimentation as used in education, I have found that youngsters at the Forest Hills High School who took a four-year course in science without regard to subject-matter areas but who concerned themselves with major problems (e.g., atomic energy, the conquest of disease) not only did well in college, but gained more honors in science in high school than any comparable group before or since.

Acceptance of the Core Program

A number of high schools have now introduced the core programs. In obeisance to college requirements these schools may record on their students' transcripts a year of English, a year of general science, a year of community civics, and a year of general mathematics, but the youngsters who have been in these core programs may have had a year of work under the general title, "Getting To Know Yourself and Your Community."

Some teachers are even rash enough to predict the day when a college admissions officer will accept with equanimity a high school program reading:

Core 1, Knowing Yourself; Core 2, Language Tools (English and foreign language); Core 3, Problems of Democracy (social studies); Core 4, Health; Core 5, Science and Its Methods (science for four years); Core 6, Mathematical Tools (mathematics, simple bookkeeping, etc.); or just Core I, Core II, Core III, Core IV; and will leave to college entrance examinations the task of determining the fitness of the candidate to profit from college work.

The direction of educational movement in the public high schools is unmistakable. Its velocity is increasing. It may even be false to call it a direction because it is so thoroughly established. The educational vector, the product of the direction and the force behind it, is the process of general education we have been discussing.

Motivation of General Education

Although general education is difficult to define, it can be clearly recognized if one looks at the process operationally. The process starts with the question, "Why are we giving this course?" continues with an investigation of the needs and interests of the students in terms of problems of living rather than in terms of subject matter, leads into experientation with consequent evaluation in terms of the objectives of the course, and develops into a dynamic relationship between teacher and student wherein both are engaged in getting significant information and experience and in using the information and experience in the solution of meaningful problems of living. The process never ends; it is its own motivation.

Broadly speaking, the process which is general education is following somewhat the same path in the colleges that it has followed in the high schools. Our operationally-minded observer will note some of the signs of an emerging concept of general education. There is a rejection of the notion of faculty psychology; there is an increasing acceptance of the belief that courses, at least in the first two years, should not be introductory but should be complete on their own level; there is an increasing acceptance of the fact that most students who take a course in the first few years do not necessarily intend to specialize in that area; there is an awareness that the students' own needs and interests may furnish useful objectives for the course; there is, in short, a clearly perceptible shift from emphasis on subject matter for its own sake to selection of subject matter for the students' sake.

The difficulties in the way of retooling are also perceptible. There are changes in course titles. There are changes in content. There are, in some places, changes in method. The major problem seems to be in recruitment of teachers for the very desirable programs which have been planned.

The High School View vs. the College View

Be that as it may, there is a pincer movement in education which will, it seems, envelop the procedures involved in college entrance, including subject-matter requirements. One end of the pincer is general education, well established and flourishing in the public high schools: high school students are graduating without having taken the courses once favored for college entrance. Yet these students seek admission to the colleges. The other end of the pincer is general education as it is being interpreted in colleges throughout the country. Looking at it from the position of one with some experience in both high school and college, it would seem to me that the movement in the colleges is as yet small, but it is formidable for it not only has behind it the force generated by the increasing demands of many more students for a college education, but it is also firmly rooted in sound educational psychology. It will grow.

Subject-Matter Tests Losing Importance

Where college faculties have accepted general education as a way of meeting the needs of their students, subject-matter testing, in its narrow sense, and subject-matter entrance requirements are losing ground. This follows since entrance procedures based on subject matter per se were established to predict the success of students in work they had begun in high school. It seems, therefore, that if this pincer movement is successful, subject-matter tests will become progressively less important and aptitude tests will become more important. But if the nature of the change itself is any indication of the way things will go, that is, if evolution and not revolution apply to testing procedures, then we will probably not see subject-matter tests give way at once to aptitude tests. It is likely that subject-matter tests will evolve into tests of "developed aptitudes." There will be a decreasing tendency to measure details retained through experience and an increasing emphasis on the measurement of "developed aptitude" to use knowledge gained to solve significant problems.

In this shift of the educational spectrum, the College Board is in a strategically important position. Such a position brings with it attendant problems. Should the board face the past and support the more or less clearly defined position of traditional college

entrance requirements and subject-matter testing? Should it adjust itself to support the development of programs of general education, which by the very nature of their genesis must differ with different educational environments? Or should it engage in a search for relative stability and look to the development of tests for aptitudes and developed aptitudes?

Board Defines Objectives

In an attempt to plot a position in a period of educational flux, the College Board has looked for a clearer definition of its objectives and of ways to fulfill them. It appears clear that the board fulfills one of its major functions when it makes available to its consumers progressively more valid and reliable instruments for the selection, guidance, and placement of candidates for college entrance. It will probably meet the needs of its consumers best when its testing devices are submitted to constant experimentation in the field. And this is one of the things the board has chosen to do.

This preliminary statement has been extended because, in a real sense, it is the *raison d'etre* of the science committee. Science by its very nature lends itself to the process of general education whether it is defined in terms of singleness of purpose, i.e., the quest for reality, or of singleness of method, i.e., the method of the verified hypothesis, or, broadly, as "doing one's damndest with one's brain, no holds barred." There is still the well-founded view that minor differences aside, all the sciences have the same pervasive aim. The observer who searches the journals of education, who reads prefaces to courses of study, who sits patiently at meetings of scientists and science teachers must conclude that there is the widest agreement on the pervasive aims of science teaching.

Science Teaching and Developed Aptitudes

He will find the widest agreement, even an unyielding position, on the belief that science teaching, whatever the field, whatever the curriculum, whatever the method, should produce students with a literacy in science. This literacy is generally shown by the ability to apply the methods of science to a problem at hand, to read and analyze scientific material, and to use the major concepts of science as they apply to modern living. This fits our definition of a developed aptitude.

Now those of us here, all tough-minded, will be disenchanted with such easily won agreement. We will erode the agreement with such valid questions as, "What are the methods of science?"; "What are its major concepts?"; "What is success in dealing with scientific literature?" And there will be many, many other questions, all of them valid, all of them necessary, all of them difficult to answer in our present state of ignorance. Nevertheless, there is the widest agreement that the pervasive aims, the hard seed of science teaching, deal not with subject matter per se, but with an understanding of its methods and an ability to apply these methods.

In addition, the conviction has grown that one type of competence (or developed aptitude) colleges have a right to expect of candidates for admission is the ability to apply scientific methods to a problem at hand and to interpret and use scientific information. This is clear as one examines the literature. And there is also the conviction that this developed aptitude can be, and should be, measured.

This last conviction is, of course, not new. It has been one of the goals of those who work at the demanding task of inventing test items. The inventor of test items is acquainted with the many efforts in the field. And indeed, the College Board has dealt with it in its various reports. Almost 15 years ago a committee of the board concerned itself with the problems of constructing tests in combined sciences.

New Science-Testing Committee Appointed

In March, 1951, a new committee on science testing was appointed by the board. The work which I will here report is based on the imagination, resourcefulness, and good sense of my colleagues on this committee: Finla G. Crawford, Syracuse University, chairman; Alexander Efron, Stuyvesant High School, New York City; W. Joe Frierson, Agnes Scott College; Philippe E. Le Corbeiller, Harvard University; Morris Meister, High School of Science, New York City; Leo Nedelsky, University of Chicago; Eric M. Rogers, Princeton University; and Richard Sutton, Haverford College. We are also much indebted to Warren Findley, John Dobbin, and Bernard Cayne of the Educational Testing Service.

The charge before the committee was clear: (1) to survey the present science achievement tests from the viewpoint of both schools and colleges; (2) to consider ways and means of attaining closer articulation of objectives in science teaching in secondary schools and colleges; and (3) to discuss the practicability of a conference at which science teachers representing schools and colleges could convene to

define purposes and discuss methods of teaching science.

From the beginning the committee took the position that an operational approach to the problem was desirable. The committee thought that some of the objectives implied in the first charge might be attained by constructing and evaluating an entirely new science test and using the experience as a basis for making useful recommendations. The "operation" agreed upon was the invention of a single test designed (1) to measure the level and scope of the candidate's scientific knowledge and his ability to apply this knowledge to solve problems, and (2) to inquire into the candidate's literacy in science as shown by his ability to analyze the principles of science, and to use scientific methods.

Feeling Comfortably at Home With Science

The rationale for the proposed test was based on the conviction that people living in a culture in which science plays such a prominent role should "feel comfortably at home" in scientific media. They should have a certain amount of scientific literacy and a certain amount of operative content in science, operative content being generously defined as the amount and kind of science which can be recalled with relative ease. Candidates intending to pursue science in college or to engage in a profession based upon science may be expected to have a considerably greater operative content in science.

The proposed test was to be designed primarily to measure the candidate's ability to understand and use science, regardless of how the competence had been developed. It was intended to be used, together with other predictive measures, as a vehicle for predicting competence to engage in college work. The test was to measure the ability of the candidate to use science in problem situations.

When the committee first pondered its charge, it was thought that it would be well to elaborate a test which would cut across all subject-matter areas; the test was to draw upon science per se, rather than to be confined to familiar arbitrary categories.

It was felt that whether or not a useful test was finally developed, the test items, or testing instrument, could serve several purposes: (1) to evolve specific recommendations in the field of science testing; (2) to illustrate in a practical way to the existing science examining committees the thinking of the committee on science testing; (3) to affect the construction of the existing science tests (indeed this might be the most important function of the work which is the subject of this report); and (4) to test the temper and attitude of consumers of CEB tests toward science testing of the type proposed.

The test, like all inventions, would be evaluated in terms of accepted criteria. Three criteria would be considered in selecting each item for the proposed test: first, the mental process which the item proposes to examine; second, the scientific concept or principle involved; and third, the amount and kind of recall necessary. The difficulty of the item was to depend upon a combination of the recall required, the mental process involved, and, to a lesser extent, the concept involved.

Trial Test Run Made

The members of the committee on science testing submitted some 150 test items. Of these, 97 were considered promising. After being edited and graded in what appeared to be an ascending order of difficulty, these 97 items were adminstered to several groups of students and teachers.

On the basis of these crude experimental excursions, the following notions could be tentatively stated. There was general agreement by the students tested, and by the teachers, that this was not alone or even principally a test of science content, but that in order of emphasis the items stressed scientific thinking and understanding of science method, understanding of principles of science, and recall of content.

Problem of Subject-Matter Loading

It appeared, however, that certain items carried with them the climate of their intrinsic content and required a type of recall (latent, if you will) which limited a student's willingness to involve himself in them. Students were prone to say, "That's physics, and I have never had it," or "That's biology," etc. This in spite of the fact that there was universal agreement among the candidates that this was a "new" type of test—one that stressed scientific thinking rather than recall. The problem of the extent of subject-loading in a general test is still with us and will require all the ingenuity which can be mustered.

As preliminary investigations, elaboration of items, discussions with teachers, study of science curricula, identification of current science sequences, and various other kinds of cerebral-searching procedures progressed, it became increasingly clear that it would also be well to consider several factors.

Students who take two years of science generally take general science and one specialized science. The latter is usually biology; however, depending

on the school, chemistry or physics may also be taken as the second course. It is difficult to avoid the inclusion of items in a general test which do not, by their very wording, favor one or the other area.

Teachers tend to identify items in terms of subject areas even though they understand that the items stress method rather than content. In terms of public relations and the acceptance of the test for wide use, this factor cannot be overemphasized.

It became increasingly clear that teachers (in their belief that each area has certain special inalienable benefits) desired certain areas to be represented. For instance, biology teachers wanted genetics, photosynthesis, etc.; physics teachers, electricity, sound, etc.

In line with these notions two tentative experimental tests were developed. One of these, Test I, a general test, consisted of 50 general items without regard to subject-matter fields. In Test I approximately 20 questions were in the area of methods of science, 10 in the area of interpretation of science reading materials, 10 in application of principles of science, and 10 in analysis of observation and experimental data. As can be expected, the categories overlapped.

A second test consisted of two parts: Part I was made up of general items; Part II was made up of separate physics, chemistry, and biology sections. In these separate sections the items had strong subject-matter loading.

Examples of types of items to be found in Tests I and II are given at the conclusion of this article. These are not in final edited form, nor validated, and are fully expendable. However, rough pretesting data showed them to be useful as fodder for the construction of a test which fits the criteria stated earlier.

It is hoped that those who examine the items will do so in the realization that they indicate the direction and the direction only, which the committee considers promising. As can be surmised, there are many problems which face us. Some of these are clearly apparent and have to do with the construction of items and the extent of subject-matter loading. Others deal with our ability to interpret clearly the pervasive aims in science education, the central purpose of programs in general education, and the vigor and tenacity of both. Other problems, large and small, will surely occur.

It is relatively easy for those of us trained in science to escape into experiment. Accordingly, a small subcommittee has been appointed to carry on the work of producing a science test which will bear the brunt of validating procedure. The present intention is to produce a test which might eventually supplement the biology, chemistry, and physics tests in the College Board's series; which, in its greater part, will cut across subject-matter lines; and which will attempt to measure literacy in science. It should be emphasized that the whole project in its present state of development is susceptible to the widest modification should experience and experiment indicate such a course.

In fact, with the preliminary work of test construction behind them, the first task of the subcommittee will be to test the hypothesis upon which the larger committee has been working, namely, that students who are successful in an examination designed primarily to determine their understanding of the strategy and tactics of science will be successful in college science. Whether or not a valid and reliable instrument can be invented to do what is proposed will appear from the evidence of further investigation.

Sample Test Items

Without Subject-Matter Loading

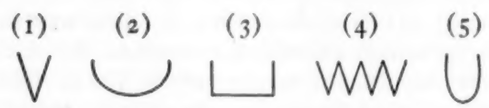
Interpretation and Analysis of Science Reading Materials

Rivers may be classified as young, mature, or old. A great deal of material is deposited at the mouth of the river, such as pebbles, boulders, silt, and clay. In a young river, water flows rapidly (sometimes with great speed). The river may carry large boulders or fair-sized pebbles and, as a result, the river bed is cut deeply.

In an old river the water flows slowly and placidly. Fine gravel, silt, and other fine particles like clay are carried and deposited wherever the slope levels off.

If for some reason (e.g., geologic upheavals) the slope of an old river is raised, the water again begins to flow with great speed. Again large pebbles and even boulders may be carried. Again the river bed is cut deeply.

1. According to the passage above, the cross-section of an old river whose slope has not been raised should be shaped like which one of the following?



2. At the mouth of a river that has progressed from youth to old age, one should find layers of material con-

sisting of boulders, pebbles, gravel, and silt in a definable order, from the bottom up. Which one of the following is the correct order?

(1) boulders, pebbles, gravel, silt.
(2) gravel, pebbles, silt, boulders.
(3) silt, gravel, pebbles, boulders.
(4) pebbles, silt, boulders, gravel.
(5) silt, pebbles, gravel, boulders.

3. If a layer of boulders is found deposited at the mouth of what was once an old river bed, it may be assumed that:

(1) The slope of the old river was raised.
(2) The slope of the old river was lowered.
(3) For some reason the old slow river carried boulders along its entire length.
(4) The old river meandered.
(5) The old river became an ox-bow lake.

Understanding and Analysis of Methods of Science

1. Boyle's law states generally that the volume of a gas kept at constant temperature varies inversely as the pressure to which it is subjected.

A sample of ammonia gas is contained in a graduated tube and is placed in a device by which its temperature is kept constant. At a pressure of one atmosphere the volume of the gas is two pints. When the pressure is reduced to one-half an atmosphere while the temperature is kept constant, the volume of the gas is seen to be four pints. Which one of the following statements is correct from the scientific point of view?

(1) The situation described is explained by Boyle's law.
(2) The situation described is contradictory to Boyle's law.
(3) The situation described proves Boyle's law.
(4) The situation described disproves Boyle's law.
(5) The situation described is predicted by Boyle's law.

2. The data below show the *total length* of a certain steel spring when various loads are hung on it.

LOAD pounds	TOTAL LENGTH inches
0	20
2	23
8	32

A. When carrying a load of four pounds, the total length of the spring will be: (inches)

(1) 4.6 (2) 5 (3) 24 (4) 26 (5) 46

B. When carrying a load of 12 pounds, the total length will be: (inches)

(1) 38 (2) 44 (3) 49 (4) 78 (5) 138

C. The answers to questions A and B above are predictions. Which *one* of the following is true in regard to their relative reliability?

(1) They are equally reliable since both are based on a well-known law.
(2) They are both unreliable since neither of them falls exactly at one of the loads in the data.
(3) A is reliable since it uses interpolation, but B is unreliable since it uses extrapolation.
(4) A is reliable since it uses interpolation in a region where the data shows that a well-known law holds; B is less reliable since it uses extrapolation beyond the region vouched for.
(5) It is impossible to comment fairly without knowing more about the spring.

With Subject-Matter Loading

Chemistry

To study the effect of heat on oxides, lead dioxide was heated and oxygen was liberated. Manganese dioxide liberated oxygen when heated. On the basis of the above statements, which one of the following conclusions is justified?

(1) In the absence of heat, liberation of oxygen from an oxide is impossible.
(2) The combination of any metal with oxygen is unstable in the presence of heat.
(3) All oxides liberate oxygen when heated.
(4) Some oxides may be decomposed by physical methods as well as by chemical reagents.
(5) Lead and manganese are active metals because their oxides decompose readily on heating.

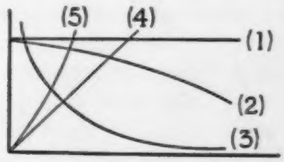
Biology

Mr. and Mrs. Y have twins; Mr. Y is blood type "A," and Mrs. Y is blood type "O." Both twins will be:

(1) "A" types.
(2) "B" types.
(3) "A" or "O" types.
(4) "AB" types.
(5) Types unknown because of insufficient data.

Physics

Questions 1 through 4 involve the following five curves:



For each of the following relationships select the most appropriate curve:

(1) Pressure in a liquid varies directly with the depth.
(2) The voltage furnished by a group of fresh dry cells is constant.
(3) Heat in a given resistance varies with the square of the current.
(4) The pressure of a gas varies directly with the absolute temperature (at constant volume).

THE PROBLEM OF SUPPLIES for ELEMENTARY SCIENCE

How One Large City Solves the Problem

By GRACE C. MADDUX

How to get needed supplies for the teaching of science in elementary schools looms large as a problem in the eyes of many teachers—all *too many,* Mrs. Maddux and Dr. Hubler would say. As they explain in this two-part article, such supplies are simple, easy to obtain, and relatively inexpensive. However, our authors go farther than this and suggest specifically what supplies seem most essential and useful and where they may be obtained.

Mrs. Grace Maddux is responsible for supervisory help in science at the elementary level in the Cleveland public schools. Dr. Hubler teaches science and science education courses at Wheelock College in Boston.

CHILDREN IN ELEMENTARY SCIENCE need to work with "things," as well as books, in trying to solve their science problems. How the teacher can acquire enough material so that children may perform experiments seems to be a major problem if the discussion from the floor at one of the meetings of the National Science Teachers Association at Philadelphia in December is any indication.

During this meeting I realized that Cleveland public schools are very fortunate in this respect. The question of securing supplies is not one of our major problems, thanks to an administration which believes that children need firsthand experiences in science. It has been suggested that the readers of *The Science Teacher* might be interested in knowing how the problem has been solved.

For the past 20 years each elementary school has had a budget for science supplies. During these years each school has been equipped with supplies fitted to the curriculum. The plan has been to use materials as simple as possible and not to duplicate the more technical apparatus used in junior and senior high schools.

Some material, such as blueprint paper for leaf prints, is expendable and needs to be replaced each year. Other items last for many years. Since group experimentation is desirable, teachers are encouraged to have enough materials to supply each group.

Each year a list of standardized items is sent to the schools. The blank contains the names and specifications of the articles. Each school orders what it wants within its budget limitation. The budget is determined on the basis of the school enrollment. The list of requirements from each school is sent to the commissioner of supplies. From the school requests a combined list of supplies is developed. This list goes to the purchasing department where bids are taken. The bids are returned to the commissioner of supplies for recommendation as to the quality to be purchased. Any question arising at this point is referred back to the science supervisor. The method of grouping the orders enables schools to secure better prices than individual schools could receive. The supply houses ship the materials to the board of education warehouse. In the warehouse the items are separated and sent to the individual schools. Many items are carried as regular warehouse stock and are available at all times as required, provided the request remains within the budget.

Schools in some communities use commercial science kits. These kits probably have certain advantages. However, the materials in the kit may not meet all the needs of a particular science program; hence, a school system that can make its own list may have a selection of materials more closely paralleling the needs indicated by its course of study.

Most public schools in Cleveland have science rooms equipped with demonstration tables and tables and chairs for the children. There are also cupboards in which science supplies may be stored. In buildings where science is taught by the homeroom teacher the supplies are kept in a centralized

location, thereby becoming available for the use of all teachers. Electric hot plates are used to furnish heat for all experiments.

At the end of this article there is a list of the supplies from which a teacher in Cleveland may order. The specifications and prices are omitted from this list. It is hoped that the foregoing suggestions may help certain other school systems solve the problem of providing adequate science supplies. Such procedures may insure having the necessary materials for making science instruction more meaningful.

- Animal Cage
- Insect Cage
- Insect Box
- Insect Pins
- Spreading Board
- Naphthalene Flakes
- Aquarium
- Aquarium Cement
- Aquarium Sand
- Microscope Slide Box
- Siphon Tube
- Test Tubes
- Test Tube Cleaning Brush
- Test Tube Clamp
- Fossils
- Iodine
- Mercury
- Potassium Bichromate
- Sulfur
- Carbon Tetrachloride
- Alum Powder
- Flask
- Pyrex Dishes
- Petri Culture Dishes
- Tubing, glass
- Funnels, glass
- Blueprint Paper
- Litmus Paper
- Test Tube Support
- Frog Eggs
- Silkworm Eggs
- Audubon Bird Cards
- Audubon Bird Charts
- Microscope Slides
- Microscope Slide Cover Glasses
- Magnets
- Magnet Stand
- Lodestone
- Iron Filings
- Compass
- Electric Bell
- Electric Buzzer
- Electric Lamps
- Receptacles for Lamps
- Electric Push Button
- Electric Fuse Plug
- Electric Switch Knife
- Dry Cells
- Toy Telegraph Set
- Quartz
- Rock & Mineral Set (Ward's)
- Passe Partout Paper
- Ozalid Printing Paper
- Cellophane
- Cellophane Glue
- Scotch Tape
- Tape Measure
- Twine
- Magnifying Glass
- Prism
- Pulley
- Pulley Block
- Plant & Flower Press
- Mounts, for plants
- Print Rollers
- Barometer Tube
- Barometer Well
- Scales
- Spring Balance
- Rubber Stoppers
- Rubber Tubing
- Thermometers
- Ball & Ring
- Tuning Forks
- Asbestos Pad
- Clay
- Parawax
- Corks

A Suggested List of Science Supplies

By CLARK HUBLER

SCIENCE TEACHERS often are called on to help elementary school teachers with their science problems. A lack of suitable teaching materials is one of the greatest obstacles in elementary school science, and uncertainty regarding what is needed may be another difficulty. Thus the chart * which follows may be a handy reference in helping to order some of the needed materials. The items listed are those most frequently recommended by five textbooks for children, seven professional references for teachers, and thirteen state syllabi. The chart of suggested sources for these items is based on a survey of science catalogues and of stores in one city. Since there is considerable variation in the merchandise stocked by stores, the list can be considered no more than suggestive, but possibly helpful on that basis.

* Adapted from the author's *Science Materials for Elementary Schools*, an Ed.D. report, Teachers College, Columbia University, New York, 1949.

It is usually recommended that science materials for elementary schools be kept in a central storage closet or room available to all classes in the building so that one supply will suffice for the entire school. The list here includes only those items most commonly recommended. A particular school may have to modify the list to fit the local circumstances. Where the budget prohibits an extensive order, a few dollars each year soon can develop an adequate supply. It may be advantageous to combine elementary school orders with those prepared by the high school.

Several items commonly recommended have been omitted from the list, for it is assumed they can be obtained by other means. Those omitted are bottles, jars, dishes, tumblers, and flower pots, tin cans, boxes, cloth, cardboard, and cord or twine, glass plates, balls, and a world globe, animals, plants, and seed. It may be that other items also can be obtained without cost. Children may be able to contribute some, and others may be constructed or substitutes used. Science teachers can perform a real service by helping the elementary schools to obtain needed materials for conducting an effective program.

COMMERCIAL SOURCES OF SCIENCE MATERIALS FOR ELEMENTARY SCHOOLS

Material Recommended	Number of Recommendations	The Commercial Source						Comments
		Variety store	Grocery Store	Drug store	Hardware	Auto supply	Scientific supply	
Tools	25	x			x	x	x	
Heat source	23			x	x	x	x	Alcohol lamp; hot plate
Copper wire	23	x			x	x	x	Insulated
Dry cells	22				x	x	x	No. 6 preferred
Magnets	22				x		x	
Magnifying glass	22			x	x		x	
Thermometer, room	22	x		x	x	x	x	
Pans and trays	21	x			x	x		
Test tubes	20			x			x	
Candles	19	x		x	x		x	
Flashlight	19	x		x	x	x	x	Borrow from homes
Glass tubing	19			x	x		x	
Iron filings	19						x	Make with file, nail
Rubber tubing	19			x	x	x	x	To fit glass tubing
Stoppers, cork	19	x		x	x	x	x	Assorted sizes
Terraria; aquaria	19						x	From pet shops; use dish pan
Alcohol, denatured	18			x	x		x	For burner
Iodine	18	x		x			x	
Balloons	17	x		x			x	
Compass	17				x		x	
Electric bell	17				x	x	x	
Tuning forks	17						x	
Salt, table	16		x				x	
Electric switches	16	x			x	x	x	
Funnels	16	x		x	x	x	x	
Stoppers, rubber	16	x		x	x	x	x	
Baking soda	15		x	x			x	
Lime, slaked	15				x		x	
Sugar	15		x				x	
Vinegar	15		x				x	
Needles, assorted	15	x			x		x	
Prism, triangular	15						x	
Wire, iron	15				x		x	
Balance, spring	14				x		x	
Flasks, pyrex	14			x	x		x	For heating
Lamp chimneys	14				x		x	
Matches, safety	14	x	x	x			x	
Paraffin, seal. wax	14	x	x	x	x		x	
Flashlight bulbs	13	x		x	x	x	x	

Material Recommended	Number of Recommendations	The Commercial Source						Comments
		Variety store	Grocery Store	Drug store	Hardware	Auto supply	Scientific supply	
Electric sockets	13				x	x	x	Small for flashlight bulbs
Microscope; slides	13						x	Borrow from high school
Mirrors	13	x		x	x	x	x	Children may bring
Bulbs, flower	11	x			x		x	Substitute onions
Metal, copper sheet	11				x		x	
Paring knife	11	x			x	x		
Barometer	10				x		x	
Bolts	10			x	x	x		Children may bring
Cages, animal	10						x	Pet shop; buy wire, construct
Starch	10		x				x	
Clay, modeling	10	x						
Electric lamp; cord	10	x		x	x	x	x	
Teakettle	10	x		x	x	x		
Thermometer, chem.	10				x	x	x	Or cooking thermometer
Beakers	9			x			x	For heating
Cellophane, colored	9	x		x			x	Save old paper
Household ammonia	9		x	x	x		x	
Litmus paper	9			x			x	
Pump, bicycle	9				x	x	x	
Rock collection	9						x	
Rubber rod or comb	9	x			x		x	Use pocket comb

Science in American History

By MOE FRANKEL

For many years American history courses have been, in the main, treatments of political and economic development. There is much to justify the questioning of this treatment. Perhaps we should consider the development of America from a broader point of view—that of its complete culture. Perhaps it is not the facts that in themselves are important but rather the "why and wherefore" behind the decisions that produced these facts. It is the contention here that science is a very important factor in this "why and wherefore" and has played an important role. It is also contended that science can no longer be omitted in any historical understanding of this country or for that matter any country. When one recalls the millions who have died in the past few years because someone created the myth of a superior race and then rested it on a scientifically false hypothesis, the place of science in history is shown in stark relief.

The history of the United States is the story of the people's long struggle for freedom and self-government. In every period of this story man has been faced with a multitude of problems, the solution of which necessitated an understanding of the many forces that determine the course of events. Science has always been *one*, and I emphasize the word *one*, of these forces. *New* applications of science bring with it *new* social adjustments to meet the *new* challenge.

Decisions of policy in this country are usually reached after there has been a sifting of opinion. Every citizen, consciously or unconsciously, has his own conception of the right or wrong of the direction in which we are heading, and decisions of policy follow from this. It is not a ballot, or the thoughts and ideas expressed through the "mass media" that determine what is to be but the countless millions of random expressions. In practically all cases these expressions are concerned with two factors: (1) the nature of the democratic process and (2) the effect on man of the applications of science. Neither can be separated from the other for science does not operate in a vacuum. Governments today act as a conditioner in controlling the operation

and application of science. The future of any people is determined by it. Dr. Vannevar Bush, as a result of his experience as a scientist working for the United States government during the past war concludes that "If the democratic process works to foster effective government, if science can cure all of our ills, and not merely provide means of destruction, men and nations can quarrel without fear. If headed over a cliff, with means of progress out of control, if the form of government is transitory and bound to transform itself into a selfish rule by some dominant group, if the application of science finally doomed all of us to die in a holocaust, there is little use to argue about the next strike or drought. The two central matters are interconnected. What science produces in way of application, within its own changing limitations, depends on what is desired by authority, by those who rule or represent a people. Pure science may go its own way, exploring the unknown, with no thought except to expand the boundaries of fundamental knowledge. But applied science pursues a path set by authority. It depends on public opinion whether it will be used for new cures, new sources of raising the standard of living, or new ways of waging the war."

It is belaboring the point to continue to elaborate on the importance of science in the world today. This is not our essential problem here. Our concern is with the "how," "what," and "why" of utilizing science in American history. As a departure it should be borne in mind that the history of science is as much a part of American history as the political history is. Grudgingly we have come to recognize that political history is what it is simply because of the determining effects of other facets of American life. It is difficult to set up a blueprint that will detail how much of the history of science should be introduced. Suffice it to say that enough of it should be included so that the "infallibility" of the text or the teacher is dulled. The end should be to make the average person aware of what the scientific method is—experiment, observation, exact and impartial analysis—as well as some understanding of what part science itself has played. As someone once said, perhaps of even greater importance is an understanding of scientists, the role they have played, and the role they are preparing to play in the future.

It is also necessary to make students aware of the fact that science is not a field that is limited to a nation, but it is essentially an international or supranational body of knowledge. There can be no American science any more than in the true sense there can be an American history. Both are parts of a total world picture.

Mr. Frankel teaches social studies and is head of the department in the Clifford J. Scott High School, East Orange, New Jersey. He has, in our opinion, some rather uncommon ideas as to how science and social studies ought to be taught and brought closer together in meaningful relations, especially at pre-specialization levels of education. In years gone by Mr. Frankel and your editor were colleagues on the faculty of the Summit, New Jersey, High School and jointly experimented with teaching units cutting across the department lines.

This article reports a speech given before a national convention of the National Council for the Social Studies, a department of the National Education Association. We asked for it for publication in *our* journal and promised that our readers would see to it that the social studies teachers in their schools would have a chance to react to Mr. Frankel's ideas.

Mr. Frankel's undergraduate work at Dartmouth College, where he was an All-American center in football, included about equal credits in science and social studies. His graduate work has been at New York University, Teachers College of Columbia University, and the New School for Social Research.

To those of us who work in the field of social studies it must be evident that something is lacking in the education of the students. We are made aware of this lack by the prevalence and success of the quack, the faddest, and the cultist of all types. And this lack is the neglect of giving science its proper place in our teaching of history. There is the obligation of stressing the scientific spirit in history as well as in the sciences; there is also the obligation of circumventing irrationality by scientific method.

But this is not all. There is also the obligation to show that science and the scientific spirit in and of themselves do not offer the solution. The social studies teachers through their classes should show that science still must be controlled by the virtues mankind considers necessary for its perpetuation. The history of the last 30 years shows that science by turning itself against humanity can end itself or at least be forced back to a position comparable to those days we call the Dark Ages.

The human equation is just as important as the atomic bomb equation and a lot less likely to become obsolete.

Perhaps you will allow me to speak from my own experiences in the teaching of American history to illustrate how the history of science can be fused

into an American history course. Taught chronologically it becomes as much a factor in understanding the period as the art, literature, education, and the economics of the period. The historians of this country have disregarded and underestimated the role of the man of science in the development of our country. For one reason or another they have not seen fit to bring home to their readers the important events in the history of science and the results of these events on the minds of the men of the day. The course of history has been changed by developments in science, and the social impacts of this change are studied without proper reference to the cause. Where American history is taught through the medium of many materials, a standard work such as Bernard Jaffe's *Men of Science in America* should be part of the required reading.

If on the other hand a topical treatment is preferred, the teacher could develop a unit on the history of science showing the relationship of each period of our history to the scientific thinking and advances of the period. Here, for instance, can be brought out the relationship of the frontier to the emphasis by American men of science on the practical applications of science. In a land that had to be subdued, a land covered with an overwhelming abundance of resources, and a land populated by so few people, it became a matter of necessity to develop technical skills and inventive capacities to the highest point. How well this was done is attested to by the record of the patent office in America.

A course taught biographically is beautifully designed for the introduction of science into history through the scientists. Suffice it to say that whatever the approach, except that involving a single text with no deviation and no supplementary materials permitted, this wealth of important material can be introduced without any apologies. The single text must be emphasized for is not the very use of a single text non-scientific in itself? To preach and not practice would be valueless. Science should be introduced not as a body of facts but as an activity, the participation in which has profoundly affected life in the past, is affecting it today, and bids fair to play an even greater role in the future.

How this can be introduced will vary with the training and background of each teacher. To those history teachers fortunate enough to possess a scientific background as part of their educational training, there is no problem. The picture of the history teacher conducting a scientific experiment to illustrate the invention or theory that had a profound effect on the thinking of the American people of the period can only elicit greater respect from the student. But to those less versed in the arts of science the procedure is almost as simple. Cooperation with the science teacher for periodic lectures and experiments to the history class in connection with a regular schedule of lectures from the music, art, and domestic science teachers serves to make the pupil fully aware of those activities of Americans that are surely valuable parts of our history.

It is also an opportunity for the youngster with a flair for science and a developed antipathy to history to take over the class and, as a result, realize the interest and greater implications of this study of man's past record.

What then is of importance in the field of science specifically that should be included in American history? There are many illustrations to show how the march of science affected and changed the social structure. One does not have to be versed in science to see the relationship between Whitney's invention of the cotton gin and the developing slavocracy. Or for that matter the relationship is evident when one considers the invention of the telephone and the development of the railroads in connection with solving some of the problems of populating the West while at the same time creating others. The steam engine, electrical power and light, telegraph, radio, auto, plane, and dynamite are further examples of a list "ad infinitum." Or to turn to another area, consider the countless developments in biology and medicine that preserved and extended the life expectancy of the average American. For every invention that created a problem there also exists an invention that helped to solve a problem. But these are the commonplace, the inventions and gadgets too often taught without any thought of their scientific relationships.

It perhaps is a bit more difficult, but a lot more important, to recognize a cause and effect relationship in the first synthesis of an organic compound in 1828 and the revolution in the minds of men that followed this disclosure. A German scientist, Wohler, by name, broke down urea, a waste product of the body, and conclusively proved that there was no difference between the chemicals of the body and the chemicals of the laboratory. The fact that man was not a thing apart, physically speaking, but simply a product of the composition of nature's elements shook the very foundations of man's society. Religion broke loose from the shackles of sorcery, witchcraft, mysticism, and magic, and established itself on a firmer foundation. Witness the revolution in American religion at this time. But even more than that was the freedom that was given to men's minds. Another fetter of medievalism was severed and America had one more piece of evidence upon which to build democratic concepts.

Or perhaps it should be brought out that at a later date another biological development created a revolution in man's society that is still in the process of being won. Darwin, in 1859, proclaimed to the world his theory of evolution. Its effects were not to prove that man was descended from the ape —a common misconception in the minds of many citizens—but rather to stimulate man's thinking along the lines of a firmer belief in the concept that all men are created equal.

As to the over-all effect that science has had on the American public consider for just a minute the trials and tribulations of the colonists in creating a Declaration of Independence and a Constitution based on a philosophy of natural laws and natural rights. Surely this could only be but the results of scientific rationalism of the 18th century.

Or consider the fact that in the midst of the turmoil that was being created by the forces of dissolution just prior to the Civil War, science was important as one factor of unity in the nation. "Science . . . knew no North or South, or very little of either. The best achievements in these fields had a national quality and touched a great many patriotic chords. At the very least they lifted men's eyes above sectional quarrels, and gave the nation a common stock in which it could take pride." So wrote Allan Nevins in his *Ordeal of the Union,* and he follows this with a brief treatment of the growth of scientific societies in this period of history, the effect and importance of the establishment of the Smithsonian Institute, the appearance of scientific journals, the scientists of the period—Mitchell and Maury of the South, and Schoolcraft and Henry of the North. These men, in the minds of citizens, were Americans not sectionalists. Can we skip over, for instance, the noteworthy contributions of Maury in discovering an improved sailing route to Rio or in shortening the trip "to California by directions that cut the time by weeks?" It was his work in the collection of data for navigational purposes that provided for this and offered a contribution to all the world.

Even this is not all. The pragmatism of William James has become the distinguishing characteristic of the American. Its development finds its antecedents in the history of science in this country. James believed, in accordance with the common men of America, "that man can effect material and social changes, that he can create, and is, in fact, creating a new civilization." He demanded that ideas be set to work—that progress was a counterpart of America. The creative individual became the center of this philosophy. And from this philosophy, many of those of us here are guided in our teaching by a disciple of James—John Dewey, whose byword has been "learning by doing."

From still another angle science has had a profound effect in determining the course of our history. Such a thing as radio is not simply a means of communication or enjoyment, but it is also a means of propaganda, a world-wide spread of ideologies, an awakening of the backward people, a counter measure to a controlled press, and a means of carrying on the battle for world opinion.

No consideration of science in American history would be complete without including the era in which we find ourselves today—the atomic era. There is no phase of our life that is not now colored by this new source of energy. Has not much of our foreign policy since the war been based on the fact that America had it and Russia did not? Industry, medicine, community development, as a matter of fact the very existence of man, is vitally tied up to this little understood phenomenon.

Lest it be assumed that science has been all positive in the development of our country, it should be mentioned that today there no longer exists the idea that science is the panacea. Let us also bring out the cultural lag that exists between many of our institutions and the present scientific fact of indeterminism. Einstein in physics, DeVries with his mutation theory, Meyer in psychiatry, Millikan in astronomy—these are men who have brought back to our civilization a belief in the Almighty, a negation of the mechanistic theory of the universe, and an acceptance once again of the concept of free will.

To complete this story of illustrations, we can make mention of that newly created science, geotechnics, the applied science of making the earth more habitable. Here is neither science nor social science but a fusion of both serving us as another approach to a better understanding of some of the most persistent problems of our day. It is not geography, forestry, conservation, and engineering separately but all of them plus others that answer the "how." It is a synthesis of knowledge—and that is the concept that should and can be stimulated in American history.

What is desired is not science emphasized to the detriment of politics, economics, art, and literature among others, but an emphasis of all to produce a whole.

If there is any value to the modern concept of education of the whole child and the development of personality through situations that produce growth, then there is value in the approach to American history that carries with it a broader base, a broader treatment than that which is secured by emphasis on political and economic history alone.

A Report From Glenmont . . .

The Second TAEF Institute

By **ROBERT H. CARLETON**

Executive Secretary, National Science Teachers Association

. . . We are living in a competitively technological age, and the success of a nation in such a field rests largely on the originality of thousands of engineers and scientists employed in its industries.

. . . An expanding economy and a consequent rising standard of living depend on new products and markets created by the technical resources of industry.

. . . Studies of England give clear evidence to the fact that a chief cause for its industrial decline and loss of world leadership was her failure to train and utilize adequate numbers of engineers and applied scientists so necessary to competitive strength and growth in our technological civilization.

. . . The United States may be heading in the same direction of industrial decline if the expanding requirements of industry for scientists and engineers are not met in the years ahead.

These viewpoints were among the highlights of those presented by speakers at the Second Thomas Alva Edison Foundation Institute for Science Teachers held November 12 and 13 at Glenmont, home of Thomas A. Edison, in West Orange, New Jersey. Cooperating groups included the U. S. Office of Education, the American Association for the Advancement of Science, and the National Science Teachers Association. Representatives of universities and colleges, industry, state and federal government agencies, foundations, publications, and 14 additional educational and professional organizations comprised the 60 participants in the institute.

Over-all conclusion of the two-day proceedings might be summed up in these words: The survival, growth, and future strength of Western civilization can be anchored to the problem of increasing the quantity *and the quality* of the engineering and scientific manpower of the United States. The problem of arresting the decreasing output of engineering schools, and of sharply increasing the supply on a long-range basis, is one the most important priority jobs facing the United States today. Nothing less than immediate and continuing, effective efforts must be put forth by industry, government, education, and the public to encourage and interest many present and future high school youth to seek careers in the various fields of science and engineering.

It is most timely to report the Second TAEF Institute now, in view of the current stage of development of the program for the Future Scientists of America Foundation. Many of the activities envisioned and now being planned for FSAF embody recommendations made at the institute. In fact, it is appropriate and a pleasurable privilege to give credit to both of the TAEF Institutes as prime factors in sharpening and guiding the NSTA course of action relative to "scientific manpower and high school supply." Although the over-all objectives of the association rest on the improvement of instruction in science for *all* youth at all educational levels, the association has concluded that the current and long-range problems of helping to alleviate the shortages in fields of scientific and engineering manpower are outstandingly critical. Hence the action program planned for the Future Scientists of America Foundation.

In the official report of the institute specific steps for immediate action recommended by the participants take up five single-spaced pages, 8½ x 11 inches in size. There are 60 specific recommendations which are grouped under nine different headings. Space permits only a sampling of representative statements from the list of recommendations.

Elementary and secondary schools should: (1) Undertake critical studies cooperatively, through state departments of education, to discover specific factors that cause high enrollment and continued interest in mathematics and science in some schools and the opposite in certain other schools. (2) Recognize the real individual differences in interests, abilities, and modes and rates of learning that characterize youth. Superintendents, principals, and teachers should constantly hammer away at the public whenever and wherever possible to educate them regarding sound educational policies concerning desired teacher-student ratios. (3) Encourage superintendents, principals, and science teachers to actively and energetically seek mutual working re-

lationships with industrial and business organizations of each community which might serve the school in relation to science and engineering. (4) Improve science courses and science training of teachers at the elementary school level in order to develop scientific interests of children when they have the greatest urge to learn.

Universities and colleges of science and engineering should: (1) Take a hard look at their drop-out rates; estimates indicate that 60 per cent of each entering engineering class does not graduate. Such a high drop-out rate tends to discourage secondary school teachers from recommending engineering as a career. (2) Establish educational programs for individuals who have dropped out of engineering and scientific schools; who, although lacking in professional ability, would make satisfactory technical assistants. (3) Encourage more girls to take up careers in science and engineering. (4) Establish intimate relationships with secondary school administrators and science teachers in each community in order to remove barriers that now cause grave misunderstandings.

Industry—large and small—should: (1) Educate its stockholders to permit greater utilization of its five per cent tax deduction privileges for grants to non-profit institutions. (2) Make every effort to place high school science and mathematics teachers, as well as vocational guidance counselors, in summer jobs that will add to their ability to become more effective teachers. (3) Establish educational programs for individuals who have dropped out of engineering and scientific schools and who would make adequate technical assistants.

State and federal governments should: (1) Through the U. S. Office of Education and state departments of education, develop suggestions and guides for teachers so that an increased number of students will have real exploratory experiences in science and mathematics in their high school studies. (2)Provide well organized and correct source lists to teachers, parents, and students indicating scholarships related to science and engineering that are available upon application and acceptance. (3) Study present educational programs in mathematics and science at the elementary and high school levels and consider how these programs and courses can be strengthened in relation to engineering and science careers.

Vocational guidance personnel and organizations should: (1) Stress the values of engineering training to students and parents as a preparation for many occupations which are often not readily associated with engineering and scientific work. Point out that many sales and industrial managers of today must be informed on technical matters in order to competently perform their jobs. (2) See that students became personally acquainted with individuals in as many different careers as possible before the student "freezes" his mind to his vocational choice.

Foundations should: (1) Finance sabbatical leaves for high school science and mathematics teachers so that they can vitalize their teaching with personal experiences in industrial, university, engineering, and scientific efforts in research, development, production, and distribution. (2) Specifically underwrite scholarship programs for girls in engineering and science. (3) Support exhaustive research studies to determine why many young people develop, during their formal educational process, a dislike for mathematics and science noting that this is in contradiction to their former interest in everything.

Local community organizations should: (1) Work for tax support for increasing salaries of science and mathematics teachers on a merit system based on individual performance and thus meet the unusual competition in specialized fields of industry and government. (2) Work for improved teacher-student ratios in the classroom. (3) Work for adequate and effective laboratory facilities and equipment for science classrooms. (4) Sell taxpayers on the desirability of each community providing sabbatical leaves for outstanding science and mathematics teachers so that they may continue their professional studies and become better informed of the developments in science and engineering of industry, government, and universities.

Participants in the institute agreed with Dr. A. H. Compton who, speaking at the 1951 National Science Fair in St. Louis, said: "Engineers and scientists, under present world conditions, provide technical strength for protection against those who could destroy our free way of life. We must sharpen the spear that we hold in one hand while we apply the trowel with the other."

To fulfill this goal, engineers and scientists are needed by the tens of thousands. To fill the pipelines, educators must utilize every opportunity to provide the required leadership, at the high school and elementary school levels, to thoroughly arouse enthusiasm and interest in science among many more students than now follow through a full sequence of courses in mathematics and science in the upper years of high school.

Copies of the full report of the institute may be obtained free of charge by sending a request to: Vice Admiral Harold G. Bowen, USN (Ret.), executive director, Thomas Alva Edison Foundation, Inc., West Orange, New Jersey.

PRECIPITATES

Announcements, News, and Views of Current Interest

An up-to-date list of GE teaching aids for science announces a new chart for the classroom, "Lamps and the Spectrum," 25 x 38 inches in size and printed in four colors. Other titles listed include booklets on "Edison and Electricity," "Story of the Turbine," "Story of Light," and "Story of Electronics" and a chart on "Fluorescent Ballast." All are free. Write to General Electric Company, Editorial Department, 221-6, 1 River Road, Schenectady 5, New York.

The Harvard Summer School special program for teachers of science, scheduled for July 1 to August 15 or 23, looks mighty good and inviting. Included in the offerings are courses to be taught by Harvard President James B. Conant and Fletcher G. Watson and Paul F. Brandwein. For further information write to Harvard Summer School, 2-F Weld Hall, Cambridge 38, Massachusetts. A number of scholarships are available for secondary-school science teachers; if interested in applying, request the "Science Education Scholarship Application" form from the above address.

A new Westinghouse booklet, "Electrical Farm Equipment You Can Build," describes in text and beautifully clear, colored diagrams 23 pieces of equipment easily built from inexpensive materials readily available. Many of these would be excellent construction projects for science students. Designed primarily for use in the 4-H Farm and Home Electric Program sponsored by the Westinghouse Educational Foundation, the booklet is available on request to School Service, Department T, Westinghouse Electric Corporation, Box 1017, Pittsburgh 30, Pennsylvania.

A new pamphlet describing the Kampmeir-Lariviere Anatomy Charts, produced by Denoyer-Geppert Company, will be found interesting and helpful to high school biology teachers and to teachers of biological subjects at higher levels. Get a copy by writing to Denoyer-Geppert Company, 5235-5259 Ravenswood Avenue, Chicago 40, Ill.

Closing date for awards under the Fulbright Act is April 15. Application forms and information are obtainable from Conference Board of Associated Research Councils, Committee on International Exchange of Persons, 2101 Constitution Avenue, Washington 25, D. C. Those available are university lecturing and post-doctoral research awards in East Asia and the Pacific.

Want to look for uranium? If so, you'll want a copy of the revised edition of the pocket-sized handbook, "Prospecting for Uranium," now available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.; price 45 cents. Published jointly by the Atomic Energy Commission and the U. S. Geological Survey it includes eight color reproductions of common uranium bearing ores. The text is designed to answer all common inquiries received by the government agencies as the result of AEC's continuing program for domestic uranium production.

Coronet Films, Coronet Building, Chicago 1, Illinois, has released three helpful booklets describing their 16mm sound motion pictures now available. Quite an imposing list, including many useful in science teaching at elementary, junior high, senior high, and junior college levels.

Two excellent articles by Professor William Schriever, physics department, University of Oklahoma, Norman, may still be available in the form of reprints if you drop him a note of request. One describes how to construct a slide-projector in the lecture desk, and the other is a down-to-earth discussion of the problems of the training of science teachers *in science*. NSTA congratulations to him on both these articles which appeared in *Science*, the weekly magazine of the American Association for the Advancement of Science.

The "Facts Fight Fears" filmstrip of the National Foundation for Infantile Paralysis has been in great demand by science teachers both in secondary schools and in colleges. Loan copies may be obtained from Marian V. Miller, Health Educator, NFIP, 120 Broadway, New York 5. To accompany the filmstrip, the high school unit—"Poliomyelitis, A Source Book for High School Students"—and the teachers guide are recommended.

A classroom project for the study of paper-making has been produced by the Hammermill Paper Company, Erie 6, Pennsylvania, and is now available at 25 cents each for a packet of needed materials and an instructional booklet. The packet includes a booklet entitled "How To Make Paper by Hand," which illustrates and describes 17 steps in making handmade paper; a 5 x 7-inch piece of Fourdrinier paper machine wire (used in the paper-making project), and several sheets of special paper for use in carrying out the project.

Palmer, Powers, & Pieper To Retire

In a half century that brought profound changes in philosophy and practices in science teaching in American schools, it was perhaps inevitable that a number of stand-out names would develop. In the old argument of whether the times make the men or the men makes the times, there seems to be no question regarding these three: they made the times. Perhaps never again will we hear of the retirement in the same year of three such outstanding figures in our field. The following accounts of their leadership and a tribute to each of these men have been written by representative NSTA members. However, your editor cannot refrain from adding his own acknowledgment and appreciation of the kindly advice, encouragement, or severe criticism, as the situation seemed to merit, which each of them has freely offered. My hope is that NSTA members may likewise become benefactors of such counsel through my professional activities as your executive secretary and editor of your journal.
Robert H. Carleton.

E(PHRAIM) LAURENCE PALMER. "Eph," as he is known to many friends, has devoted most of his professional life to teaching in the region where he was born and where he received his formal education. He was born in 1888 at McGraw, New York, and in due course of time he earned three degrees at nearby Cornell University. Following six years at Iowa State Teachers College he returned to Cornell and has served on the staff there since 1919 except for time spent in the navy or while away teaching.

Dr. Palmer came to know nature study by working with Liberty Hyde Bailey, Anna Botsford Comstock, and others who helped launch a revitalized idea of what science studies might be like. He has tried to bring an understanding of nature study in its best connotations to pupils, teachers, college professors, laymen, and others. In such efforts he has taught at many colleges and universities, lectured at teachers meetings, and carried on field work far from "Cayuga's Waters." He has frequently taken youth and adults on field trips at times and places where others saw no opportunities for nature study trips. He has used mass media such as radio to demonstrate nature study lessons. The *Cornell Rural School Leaflet* has over the years revealed his amazing creativity and versatility. The *Nature Magazine* articles have revealed his attention to organization and details. A large number of articles in professional journals have revealed his impatience with superficial scholarship. His critical guidance of many graduate students has revealed his devotion to research. His services as an officer (including presidency of the Department of Science Instruction of the NEA) and as a member of many professional, scientific, and social organizations have revealed his eagerness to work with others. His ability to tell a good story and to laugh at a better one have revealed his keen sense of humor. His work in scouting, camping, conservation education, and writing have revealed his deep concern that science can and must go beyond the classroom in order to make science a way of life.

In the years ahead many of you will undoubtedly have a chance to come to know Dr. Palmer personally since he will extend his influence through services as director of educational activities for the National Wildlife Federation. He will continue to call 206 Oak Hill Road, Ithaca, New York, home.

S. RALPH POWERS. Professor Powers, head of the department of the teaching of natural science at Teachers College, Columbia University, is retiring this year after 29 years of outstanding service in that institution. Since 1912 he has devoted his energies to the teaching of science—until 1916 as a high school teacher in Terre Haute, Indiana; then for four years in the high school of the University of Minnesota where he completed his doctor's degree. After a year's work at the University of Arkansas, he was called back to the University of Minnesota where he served two years before going to Teachers College where he has remained.

Most of his many hundreds of students and countless others who know him chiefly through his writings and lectures will agree that for the past quarter century Ralph Powers has been the outstanding science educator. Much of his leadership has been demonstrated as chairman of national committees. He chaired the committee representing NSTA and the AAAS Cooperative Committee which, at the request of the U. S. State Department, prepared the report of *Science Course Content and Teaching Apparatus* for distribution to the war-devastated countries. He was chairman of the committee which wrote the Thirty-First Yearbook of the National Society for the Study of Education entitled *A Program for Teaching Science*. However, last February in an address at the 25th anniversary

dinner of the National Association for Research in Science Teaching he pointed out that were he to have responsibility for a yearbook today, it would be quite different from that in 1932. Such a yearbook, he said, would reflect our changed conception regarding the nature of the learning process; it would hold that the generalizations in science which are important to students will emanate as concomitants from their efforts to deal successfully with what they accept as *their own* developmental tasks. Such a change in position on educational theory is, in the eyes of this writer, another striking example of his outstanding leadership in science education.

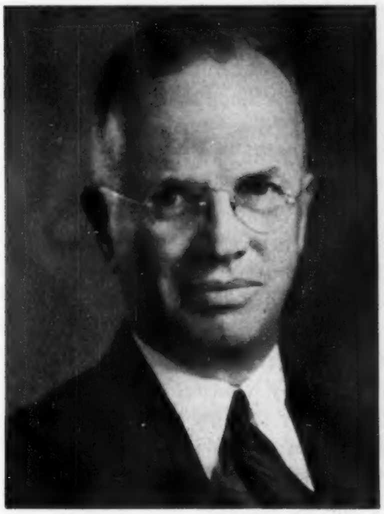
Dr. Powers was born in Petersburg, Illinois, in 1887. He is now making his home in Haworth, New Jersey. From this point his writings, lectures, and other activities will continue to flow out and into the matrix of science education.

CHARLES J. PIEPER. After teaching in Indianapolis and the Universities of Minnesota and Chicago, Charles J. Pieper became professor of education and chairman of the department of science education at New York University where he has directed the educational programs for thousands of science teachers.

He was editor of *Science Education* during the years when it became established as the outstanding medium for reporting research in science education. He encouraged and helped to implement the decisions of the National Association for Research in Science Teaching, of which he was a charter member, and the National Council on Elementary Science to make *Science Education* their official journal. In classroom and seminar he has demonstrated a remarkable ability to arouse in his students an abiding interest in the philosophy and concepts of science and their relation to personal and social behavior, attitudes, and ideals. His is a thoroughness of lecture, demonstration, and discussion which probes ever deeper into the observations supporting the fact—deeper into the exact nature of the relationship between phenomenon and phenomenon. His lectures highlight, as his conduct illustrates, a painstaking search after the data—all the evidence that can be found—and then a careful searching identification and endorsement of an attitude or a careful charting of a course of action, whether in personal human relations or in professional planning, fully reflective of all the evidence available.

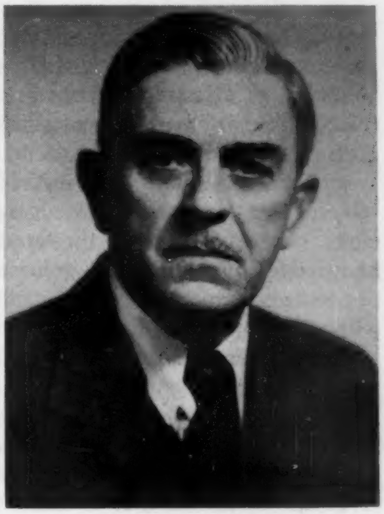
As a member of the committee that wrote the Thirty-First Yearbook of the National Society for the Study of Education he prepared the recommendations concerning the science program of the junior high school years. Here he urged, 20 years ago, that junior high school science experiences be organized around common personal and social problems of human adjustment to the materials and forces of the environment. Criteria of a problem and of an adjustment or behavior worthy of study and practice by boys and girls were proposed. It is interesting to note that this belief in the importance of science education for personal and social adjustment has been shared by so many in more recent years.

Professor Pieper was born in Avilla, Indiana, in 1887, and his home is now in New Rochelle, New York.



E. Laurence Palmer

S. Ralph Powers



Charles J. Pieper

The Science Teacher's Objectives and Their Sources

By JOSEPH ZIPPER

The science teacher, in his efforts to guide the children and youth of today to successful growth and development, is constantly faced with the choice of various educational aims and of various procedures to attain these aims. In an age when knowledges and methods classed generally as science have exercised vast influences in changing patterns of behavior, the teacher of science in cooperation with other teachers must assume responsibility in planning a curriculum which will result in the adjustment of the whole student. In a democratic society which is ideally committed to the fullest possible realization of personal potentialities and the most effective participation in that society by all of its members, the science teacher is looking to the successful adjustment of each student to the student himself, to the student's physical environment, and to the social groups in which the student lives.

Issues in Science Education. The fundamental issues current in the teacher's choice of objectives are varied. First, the science teacher has the duty to relate the activities of the students in his classroom to other activities of their lives. The activities of the science classroom are not to be cut off from the experiences in the other classrooms, in the home, and in the community; these are all part of the individual who is living them, and the clearer the lines of relationship established between the various sources of learning, the more effective will be the total adjustment of the student. Second, the science teacher has the job of guiding the student to do, as well as to know and to feel; here the final responsibilities lie within the individual student himself, moving from the knowledge of scientific principles and concepts to the application of these knowledges in meaningful situations to the solution of problems. Third, the science teacher is confronted with the impending dichotomy in the content of science and in the procedures used to attain individual and social objectives. The main differences here are between the principles of science organized by one artificial criterion or another, between academic cataloguing of concepts and the application of the principles used as a basis for intelligent decision and action. The popular misconception that identifies science with its products instead of with both subject matter and methods of inquiry must be corrected. Fourth, the science teacher faces the task of filling the intellectual gap which lies between the men of science and the average citizens of our democracy, and even between men expert in one science and those expert in other sciences. The relationship between the expert and the citizen in a nation the economy of which depends on a handful of experts in the scientific fields is an enormous problem of communication.

Current Problems of Home and Community. The science teacher will be guided in his choice of objectives by his knowledge of current problems in the home and in the community in which he and his students live. The youths learn through seeking to achieve purposes. These purposes are often derived from their homes and their communities. Many purposes are common to all because there is a constant interaction of members in the many social groups. Modern youth share many problems to the solution of which an understanding of science is applicable; some of these problem areas have been identified by the National Committee on Science Teaching as: health, recreation, safety, work, consumership, interpersonal relations, conservation, maturing philosophy of life, and responsible socio-economic action.

As specific problems are identified by the students under the guidance of the science teacher, the learning activities can be planned as steps to be taken in solving the problem. Scientific knowledges thus become the basis for decision and action. The learners gradually and progressively become more capable of making decisions that are compatible with available evidence. Problem-centered groups face community problems like blood shortages by collecting pertinent information from many sources and people, by making counts, typing, staining smears in their school laboratory, by visiting laboratories in the local hospitals, and by making donations. They study and participate in programs involving rat eradication, or the restoration of wildlife in cooperation with the game commission and the sportsman's league, or conservation of the soil under the guid-

As we've said before, every teacher who teaches does so in terms of definite objectives. They may or may not be identical with those stated in the course outline or syllabus, and they may or may not be in harmony with generally accepted philosophy of the school. What is the source of the science teacher's objectives? Those of us who missed Joseph Zipper's discussion of this question at the AAAS meeting last December in Philadelphia will welcome this article. It reports the author's views as given in the symposium held by Section Q on the education of the science teacher.

Dr. Zipper is professor of biology and education at Gannon College, Erie, Pennsylvania. His undergraduate work was done at Edinboro, Pennsylvania, State Teachers College, and he holds M. A. and Ed. D. degrees from Columbia University. He has also done special graduate work on algae at the University of Pittsburgh.

ance of the soil conservation agent and the county agent, or the control of the gizzard shad and the sea lamprey. They search out and identify inadequacies in their diets and plan remedial programs and then make the information available to the whole school; they investigate and evaluate the hygienic practices of local restaurants by using simple culture techniques.

Children and youth learn only what they accept. When the curriculum becomes dominated largely by an academic study of problems of the past or of the teacher's choice, a lack of interest and reality becomes evident. The needs of the students and of the community become objectives in the classroom of the science teacher whose knowledge of current problems in the home and community guide him in planning the science curriculum.

CONCEPTS OF BASIC SCIENCE. The science teacher will be guided in his choice of objectives by his concept of basic or fundamental science. The teacher who views science education as a means of teaching the students to employ the elements of scientific methods, to learn functional understandings of scientific concepts, to realize the significant social implications of scientific principles, to develop skills in experimental work and reflective thinking, and to develop scientific attitudes, must use different approaches to learning than he who conceives of basic science in terms of neatly packaged bundles of knowledges. If the role of knowledge in education is to promote all phases of growth and development of youth, then youth must use these knowledges in realizing their own welfare and that of their community. The dichotomy in the subject matter of science and in the learning procedures to attain individual and social aims is increased when the teacher places emphasis on arbitrarily organized content or on the techniques of teaching, rather than on a use of content and method of inquiry in the students' lives.

STATEMENTS OF VALUES. Educational policy makers have made many statements to guide the development of education, and it is necessary that the science teacher scrutinize these broad directives with a purpose to determine his own functions in the implementation of these policies and in the future evolution of new policies. Many of these statements call for specific applications of scientific knowledges and methods as does the President's Commission on Higher Education in its directing the student "to maintain and improve his own health and to cooperate actively and intelligently in solving community health problems" and "to understand the common phenomena in one's physical environment, to apply habits of scientific thought to both personal and civic problems, and to appreciate the implications of scientific discoveries for human welfare" and "to acquire and use the skills and habits involved in critical and constructive thought."

Throughout the reports of different policy-making bodies the objectives of education are directed to the intelligent solution of personal and socio-economic problems and to effective participation in a democratic society. The accent of the aims of education is on the doing, the practice, the participation; the aims are active and direct the use of science content and science methods in a democratic setting.

STUDENT'S NEEDS AND PURPOSES. The student's purposes and needs are what make knowledge useful and meaningful. The students learn through seeking to achieve purposes and to satisfy needs. Children and youth learn only what they accept, and through behavior give expression to what they learn. The science teacher is guided in his choice of objectives by the personal problems of the students who use science. The fundamental direction of the learning process comes from within the learner; the teacher of youth seeks to guide them in attaining their purposes and in recognizing broader purposes in their lives. Effective education deals directly with the problems of the students. Problems of personal health and hygiene, of personal concern about the nature of the universe, of curiosity about the nature of one's self and human growth and development, of fear about atomic warfare, of confusion over the philosophy of science—these are all problems of modern youth who may seek their

solution in the investigation of science. Personal concerns over community problems like conservation, public health, limited food supply and the growing population, man's place in the cycle of nature, interrelationships and controls of living organisms—many of these are recognized by modern youth as important and identified as areas in which personal study and decision for action must be taken.

THE SETTING. The setting, that is, the location of the experiencing through which the science students learn, must be one in which they may consider many divergent ideas and points of view as they develop their own tentative conclusions and attitudes. In a speech at the 25th Conference on the Education of Teachers in Science, S. Ralph Powers said, "The school should be looked upon as a regional institution deriving its objectives, or purposes, or reason for being, from the region or community which it serves. That is, the setting must be where we are."

In such a setting, the objectives include all areas and all endeavors to which people of the local region react; as students work collectively to solve their personal and community problems under the guidance of their teachers, and as they work to put their conclusions into effect, they learn to use the elements of the scientific method. Interest in the process of science is fired by their becoming real participants in the process and their realizing success by its use. Appreciation for scientific truths and the endeavors of scientists is enkindled by their striving to practice science. Skill in the use of equipment and in the evaluation of tentative conclusions is sharpened by actually doing a job and seeing the concrete results of that action.

Group process seems to be, in its highest interpretation, the scientific methods put to use by a number of individuals in democratic cooperation. Many of the attitudes, accepted and classed as scientific, are valued in group process. The goals of the group of students may involve policy-making, policy-evaluating, program-building, fact-finding, coordinating, and acting on decisions. Problems attacked by a student group may involve those of group action in which the group decides upon a solution and puts the solution into operation, those of public policy on which the average member of the group only wishes to recommend some action or to hold an intelligent opinion, and those of personal conduct which are encountered daily by nearly every member. Students in the science classroom may identify, select, and define problems; they may collect data from many sources like newspapers, magazines, pamphlets, textbooks, references, museums, zoos, laboratories, experts, documentary films and filmstrips, field trips, local surveys, radio, television, movies, interviews, conferences, letter correspondence, and other personal experiences; these data may be interpreted and presented for group consideration by methods like the round table, forum, or panel discussions, individual reports, lectures by experts, photographs, posters, scrap books, demonstrations, maps, charts, graphs, tables, and diagrams. Then hypotheses may be suggested for group deliberation and appraisals made to obtain a consensus; if conclusions involve directions for action, then action may be provided for by the group agencies; final evaluations may be made in the light of achievements of accepted goals.

In such a setting, wherein individual and socioeconomic problems are handled by a group of students, the science teacher must be as willing to learn as is the student in facing novel situations; he must realize that the problem-solving attitude gives purpose and direction to the thinking of the group.

What Is It?

Louis Panush, editor of the *Metropolitan Detroit Science Review,* sent us this interesting "shot" taken by a science club member as Mr. Panush was giving a series of demonstrations at a meeting. Just as the picture was taken another teacher dropped by to heckle the demonstrator who claims that the question-mark whirl of smoke above the heckler's head gives a proper "what-are-you-doing-here?" touch to the resultant picture.

Science in the Service of Youth's Interests

By STEPHEN ROMINE

Science instruction can be awfully dull. And all too often it is. In an era when science is so important, such a situation is deplorable. With all of its potential for better living, science should make a real contribution to the general education of all pupils. Many schools are not seizing the opportunities which exist, and in some science enrollments are lagging.

One approach to more and improved outcomes is through the interests of boys and girls. Many of these relate closely to science. Such interests offer clues for the selection and organization of learning materials and experiences. In using them motivation may be more intrinsic and effective, and more sustained effort may be forthcoming on the part of the learner. Interests also provide the alert teacher with insights into pupil needs and problems. In dealing with these, science instruction may serve young people and society more realistically.

Attention to pupil interests does not mean abandonment of other goals and objectives. In many cases it will enable teachers to do a better job with materials and experiences ordinarily included in science courses. However, for many pupils it likely will mean that more emphasis be placed upon practical and everyday aspects of science and less upon highly technical information. Adaptation of courses to meet individual differences permits variation according to the requirements of the particular class or school. Interests offer a basis upon which to make adaptations.

Utilization of youth interests also means that teachers begin with concepts and use illustrations already understood to some degree by the learner. This is educationally sound, and in no way does it prevent the expansion and enrichment of courses. Pupils and teachers must work cooperatively in this approach to science, a fact that promotes better teaching and better learning. Attention to interests does not mean the "watering down" of courses.

> A continuing problem in the minds of most science teachers is how to provide or grasp hold of learning situations that are really challenging to the students—situations in which the students can identify problems that are *their own* and thus provide a real reason for them *wanting* to learn.
>
> The techniques and procedures used to discover, instigate, or inflict such situations are many and varied. Perhaps the best ones cannot be planned, at least not very far in advance (as in a topical-outline form of syllabus complete to the last detail).
>
> Suggestions for using situations based on the interests of youth are set forth in this article by Dr. Stephen Romine, who is associate professor of education at the University of Colorado, Boulder.

Determining Youth Interests

The process of pupil-teacher planning is an excellent means of ascertaining and using pupil interests. A number of specific steps may be taken. For example, a class may develop a checklist of possible interests and use it to analyze and synthesize the interests of the group. Pupils may also be asked to bring in ideas or materials about which they would like to study, or to raise questions which they would like to have answered. A science museum or exhibit may provide clues concerning pupil interests. Or teachers may simply ask pupils to express interests which they (the pupils) believe are appropriate to the work in science.

Educational literature also reveals a variety of youth interests. Many of these may be dealt with in science. However, no school should rely solely on studies presented by others; it is desirable that each school make its own, or that each class in science take stock of the interests of the pupils enrolled. Variations are inevitable. Published materials do offer ideas for local studies and may be used as a guide.

In determining the interests of a class, the study should not be restricted solely to science interests. There are broader areas of concern which may be

included in other fields as well as in science. For example, pupils may be interested in developing a strong, healthy body. Science (particularly biology or physiology) may do much with, and for, such an interest. So also may courses in health and physical education or homemaking. Numerous other illustrations might be cited. It is important, of course, that teachers in the various fields of instruction work together so that both unnecessary repetition and gaps may be avoided in the total educational program.

Some Useful Pupil Interests

There are numerous interests which the science teacher may utilize. These range from a desire to grow roses or raise pets to that of wishing to understand atomic fission. In visiting science classes the writer has found that pupils are interested in many things which are legitimate to a course in science and which may be employed to enliven instruction. Less often has he observed careful and well planned use of these. Of course, such observations are not limited to science instruction.

Listed herein are a few larger interests determined in a comprehensive study made of Colorado youth. These are presented to illustrate a variety of topics with which science instruction may deal. They are not topics which relate only to science, however; the science teacher may easily get at others more specifically related to given courses in science. Consider the following topics which boys and girls indicated that they would like to study:

- How to think for myself and attack problems intelligently
- How to study effectively and do better in school
- What physical, mental, and emotional changes occur in a person as he grows up?
- How to build a strong, healthy, and graceful body
- Human growth, maturity, and reproduction
- Worries, feelings of inferiority, anger, conceit, self-consciousness, loneliness, and other problems—how they come about and what you can do about them
- Deciding what job (jobs) you would like to enter
- How to get the most for your money and make it go farther
- Participating in some activities of your own choice as hobbies, such as art work, woodwork and other crafts, photography, gardening, raising pets, and others

These few suffice to suggest the wide range of possibilities. In dealing with them science instruction may well overlap into other fields, and the opportunities for correlating science and other fields should not be neglected.

Dealing with Pupil Interests

Specifically how may a science teacher employ youth interests to promote more effective instruction, and how may he contribute to the satisfaction of these interests? Unless this question can be answered through a vigorous program of action, there is little value in being concerned with interests. A few suggestions are offered in terms of the interests previously enumerated.

All courses in science have hobby possibilities; in fact, many hobbies have a basis in science, such as photography, prospecting, gardening, radio, etc. Attention to such interests in general science, biology, physics, or chemistry is not difficult. Individual projects bearing on the given area of interest are possible, and teachers may work into units of instruction elements which bring these hobbies into the picture. At the same time, the field of science offers many vocational possibilities. Teachers may legitimately explore such possibilities with pupils. The role of science in agriculture, mining, medicine, industry, business, homemaking, nursing, and other areas is an important one. In outlining how science serves mankind and the many job opportunities in the fields of science, general student interest may be greatly stimulated.

The problem of worries and so on is well suited for inclusion in a biology course, as also are topics relative to human growth, maturity, and reproduction. The latter topics require careful planning if they are to be dealt with in the curriculum. The building of a strong and healthy body may entail several units of instruction developed specifically to deal with the many aspects of this large topic. Pupils having particularly strong interests in this area may do special work or assist in the teaching process. Close pupil-teacher cooperation may yield personalized instruction of much value to the class. This sort of teaching involves attitudes, habits, ideals, and other aspects of behavior in addition to science concepts and understandings.

The physical, mental, and emotional changes which boys and girls undergo in growing up pose many problems for them. Science certainly can help with these. The consumer aspects of science may be dealt with in general science, biology, or chemistry to help pupils spend more wisely. Particular units dealing with such things as cosmetics, soaps, dentrifice, and so on, provide approaches to interests in this area.

Science teachers, in fact all teachers, have an obligation in assisting pupils to learn how to study more effectively. Pupils are interested in this, and outcomes in science may be stepped up by improving the ability of pupils to learn. Learning to read

science materials offers one way in which a contribution may be made, and time may legitimately be set aside in science courses to deal with this skill. Emphasis upon problem solving and upon helping pupils learn how to think and apply themselves is important. Countless opportunities exist in science courses for such activity. It must not be assumed, however, that the existence of these is any guarantee that pupils will emerge from the courses with great gains in the abilities involved. Teaching must be aimed specifically at helping pupils attain the ability of thinking and of tackling a variety of problems intelligently.

The suggestions made herein illustrate a few ways in which science instruction may deal with pupil interests. Separate units may be developed in terms of some interests, such as those pertaining to health or to vocations in science. Other units in courses may use pupil interests as an introductory medium, or group and individual projects may grow out of these units in terms of the particular interests. The pupil-teacher planning involved in these procedures is valuable for improving instruction. The mere fact that the teacher evidences a genuine concern for pupil interests and attempts to meet underlying needs may give vitality to science courses.

Elementary Safety Conference

The appalling accidental death and injury toll claimed among young children is the impetus for the National Conference on Safety Education in Elementary Schools to be held on the campus of Indiana University, August 18-22. Elementary school people from all parts of the United States are invited to participate in this working conference to be administered by the National Commission on Safety Education of the National Education Association.

Teachers, principals, supervisors, and superintendents will consider ways in which safety education can be made more effective and will devise their own recommendations in discussion groups. All elementary school personnel interested in attending should contact Norman Key, secretary, National Commission on Safety Education, 1201 Sixteenth Street, N. W., Washington 6, D. C.

The possibilities in science are many. It is to be hoped that this field of instruction may increase its contribution to the education of boys and girls for living in a modern, scientific world. The utilization of youth interests offers one approach which teachers cannot afford to neglect.

The West Coast Nature School

By GERTRUDE W. CAVINS
Professor of Chemistry and Science Education
San Jose, California, State College

IF "THE PROPER STUDY of mankind is man," then the proper study of the natural sciences is nature, some members of the natural science faculty at San Jose State College in California decided many years ago.

One result of that decision is the West Coast Nature School, affiliated with, but not a part of, the college. It held its first one-week session at Big Basin in the Santa Cruz Mountains in 1931. Since then 44 sessions have been held. Since 1949 a trip has been taken to Death Valley during the Easter vacation, and the 1952 expedition will be the school's 46th session.

More than 4000 students, from those of college age to adults of mature years, have enrolled in the West Coast Nature School. Its 47th, 48th and 49th sessions will be held next summer at Yosemite National Park (June 15 to 21), Fallen Lake Lodge in the Lake Tahoe region (June 22 to 28), and at Asilomar on the Monterey Peninsula (June 29 to July 5).

The tie between the West Coast Nature School and San Jose State College is both a personal and an academic one. Ever since the school began, its instructors have been present or former members of the college faculty. The college accepts two quarter units of credit from those attending one of the week-long summer sessions so that by enrolling in all three of the sessions a student may earn up to six quarter units of college credit. Because the West Coast Nature School is not supported by state funds, a $15 fee is charged for each session and the school is self-supporting.

West Coast Nature School sessions are always scheduled in a region of general interest and operate from a definite headquarters. Each day trail groups leave under the leadership of the several members of the staff, exploring the resources of the region that lie in the fields of special interests of the staff members. Throughout the week the groups rotate in such a manner that each student takes a trip with each staff member. Conducted tours to points of interest not visited on the regular study trips are scheduled each afternoon, and each student is required to participate in three of these. Each evening a lecture session is scheduled featuring illustrated talks on topics pertinent to the region. Time is allowed for rest and recreation.

Since there are no textbooks, no home work, and no grades, the West Coast Nature School makes a strong appeal to students who have been faced with these hurdles for nine months. Teachers who have been lecturing, grading papers, and coping with disciplinary problems also appreciate the atmosphere, both literal and figurative, in which the West Coast Nature School operates.

During each session the students learn about the geology and physiography, the trees and shrubs, the wild flowers, the birds, the mammals, and the principal smaller animals of the region. Locations selected for the school are those which every student hopes to revisit throughout his life in California.

Sessions have been held at Big Basin in the Santa Cruz Mountains, Yosemite National Park, Fallen Leaf Lake, Big Bear Lake, Lassen National Park, Lake County, Redwood Highway, Death Valley, Asilomar, Idyllwild, Mammoth Lakes, Mendocino Woodlands, and Sequoia National Park.

In many of these locations, the school has contracted with established resort operators for cabin accommodations and dining facilities. Beginning with the Death Valley session in March, 1942, organized camping groups of students have been established for the trips to the desert and for the first session of the summer program. This year the Death Valley camping group will number 180 students and most of the staff members.

Campers provide all of their own personal and camping equipment, but the camp director plans meals and procures food and makes all arrangements with the area officials. He organizes cooking groups, helps arrange transportation, checks on equipment needs, and is generally responsible for the welfare of the campers.

This year the West Coast Nature School staff will again be headed by P. Victor Peterson, president of Long Beach State College and a former dean at San Jose State, and the author will handle registration for the school.

CLASSROOM ideas and demonstrations

General Science

The Big Show

By DAVID BENGELSDORF, Supervisor-Instructor, Elementary Science Education, Pleasantville, New York

To every junior high school science room there comes, in the course of the term, a collection of animal life that is indeed fascinating. They are stuffed and alive; both old and young, but a never-ending source of pupil interest. The problem of utilizing these visual representatives of life to the fullest extent is an old one. Too often they remain as decor to enhance the appearance of the room, eventually to gather dust or be sent away. This problem was attacked by the seventh-grade science club of the Bedford Road School in Pleasantville in a somewhat unusual manner which is filled with correlative material.

It was decided by the club that a zoo be formed. There were nine animals in the room at the time: a mallard, squirrel, opossum, and pheasant—all stuffed. Very much alive were the milk snake, "box" turtle, and golden hamster. Each pair of youngsters selected a subject and immediately set out to acquaint himself with that specimen. As the research into the life and habits of the animal progressed several youngsters devised signs to advertise the zoo. The research material was condensed into a talk which was written in their English class, and limited to three minutes as a public speaking project. Two additional minutes were to be allotted to a question period after each presentation. The partners alternated in the presentation and in answering the audience's queries.

Rehearsals were held during the club period, and the zoo was coordinated by an elected "ringmaster." It was presented before the primary grades with the participants frequently switching subjects so that they all became familiar with different forms of animal life.

The enthusiasm for this type of "show" was instantaneous and it was followed by several performances in the upper elementary grades.

This represents one way in which the activities of science clubs can be coordinated with the needs of the school in a manner that is vital and interesting on any grade level.

Elementary Science

Growing Plants in a Seedbox

By DWIGHT SOLLBERGER, Head of the Science Department, State Teachers College, Indiana, Pennsylvania

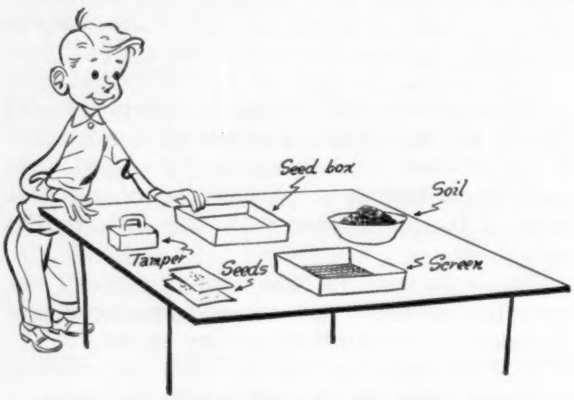
In the February issue of *The Science Teacher* directions were given for germinating seeds in a germinator made from cookie tins and paper toweling. However, if you wish to have plants for potting or for your garden, you will need to start them in a seedbox containing soil. Here they will continue to grow, developing leaves and making food material. Later on, when they are large enough, you may wish to transplant them. Plants started in the germinator will show you certain things about what makes seeds grow, but the young plants will not be in suitable condition to transplant.

Marigolds and zinnias are almost sure to grow and produce flowers, while tomatoes and cabbage

would be good plants to start for the vegetable garden.

Materials Needed:

1. A seedbox 8 inches by 12 inches with a depth of 2½ inches. The length and width of the box may vary according to the number of plants wanted. However, since moist soil is quite heavy, several small boxes are usually preferable to a single large one. The bottom of the box should not be watertight. Quarter-inch spaces should be left between the bottom boards to provide drainage. Several one-quarter-inch holes will serve the same purpose.



If you wish to have plants for potting or for your garden, you will need to start them in a seedbox containing soil. Here they will continue to grow, developing leaves and making food material.

2. A container for mixing soil
3. Clean sand, garden soil, well-rotted leaves or sphagnum
4. A tamper
5. Seeds
6. Sprinkler—a clothes sprinkler will do
7. Newspapers or paper towels
8. Glass cover of same size as the seedbox
9. A supply of small pebbles, approximately one-quarter inch

Procedure:

1. Cover the bottom of the box with two thicknesses of newspaper or paper toweling to prevent the soil from washing through.
2. Cover the paper in the box to a depth of one-half inch with small pebbles to promote drainage.
3. Make the soil mixture containing one part of sifted sand, one part sifted garden soil, and one part sifted humus.
4. Fill the seedbox to overflowing and level it with the top edge of the box by scraping off the excess soil with a straight-edged block of wood.
5. Tamp the soil down tightly with the tamper until the soil level is one-half inch below the level of the top of the box.
6. Moisten the soil thoroughly with the water sprinkler.
7. Make straight grooves one inch apart in the soil with a corner of a block of wood. These should be about twice the depth as the width of the seeds to be planted.
8. Place the seeds in the grooves and cover them with the same soil mixture used to fill the box. Be careful not to get the seeds too close together. Most seeds should be one-half inch apart. Seeds should be covered to twice their width. Very fine seeds are simply pressed into the soil with the tamper.
9. Tamp the soil tightly about the seeds with the tamper. The soil mixture used will not cake.
10. Moisten the soil again with the fine spray. Place the glass cover over the seedbox and place where the temperature ranges between 65-75 degrees.
11. When the seedlings develop, place a stick under each end of the piece of glass to allow air to circulate over the plants. Remove the glass entirely after the plants have developed several leaves or have reached the glass.
12. Water the plants as needed. Germinating seeds should be kept moist. The glass cover will help to keep the soil moist by preventing loss of water by evaporation. Soil is moist enough if it leaves a soil stain when rubbed between the fingers. If it crumbles and brushes off, the soil is too dry.
13. After the plants have developed true leaves (the leaves that appear after the two seed leaves) they may be transplanted to small pots first and then successively larger pots or to the garden.

Outcomes. As a result of growing plants in the classroom children will learn that seeds need water and certain temperatures of heat to germinate, that seeds contain food material, that the first leaves to appear are cotyledons, that plants make food in leaves, that it is fun to grow plants, how to make a seedbox, and many other useful learnings. The methods used by scientists will be practiced by the youngsters as they make observations of materials and reach tentative conclusions.

General Science

Experimenting With Experimental Methods

By H. SEYMOUR FOWLER, Assistant Professor of Science, Southern Oregon College, Ashland, Oregon

One of the primary functions of science teaching is the development in the student's mind of a healthy skepticism. The partial accomplishment of this function can be carried out particularly well in the ninth-grade general science courses. Almost any text devoted to general science is literally filled with statements of exact weights or lengths of things and individuals, of definite distances between objects, and of the composition of other objects given in percent. These designations of weight, length, distances, and composition are by implication the final word. These figures give us as teachers the ammunition for the development of the healthy skepticism in the student. The very nature of our students makes possible the accomplishment. A typical high school freshman is the epitome of the skeptic. It is at this level that the teacher can take advantage of both of the aforementioned characteristics and really make progress in the teaching of the experimental method.

One such instance in the author's experience comes to mind. The class was neither superior nor dull, although portions of both ends of the normal bell-shaped curve were represented. On the whole the class was of average mental ability.

In this case the class was studying a unit on water. The author of the text which was used in the class had listed the percentages by weight of water in various food substances. One of the boys in the class became skeptical of the flat statements of percentages. The author of the text had listed the water content of an apple as 85 per cent. This boy was convinced that certain varieties, in particular MacIntosh and yellow transparent, contained more water than did crab apples. A girl in the class said that she had learned in home economics that the water in an apple amounted to 90 per cent of its weight. With this remark she had added, "Which is correct?"

There was but one answer as seen by the writer. This was to admit that he didn't know. However, a lively discussion ensued when the class was asked, "How would you find out?"

One member of the class said that we could go to the local cider mill and find out how much cider was made from a bushel of apples. This suggestion was vetoed in short order by other members of the class who reminded the first member that cider consisted of more than plain water. Another suggestion for drying the apples met with an equally enthusiastic veto.

After other futile suggestions had been made, one member of the class suggested that the apples might be "burned" and still keep the ash. This method was approved by the class. A covered crucible was decided upon as a container. The class then decided on its method of procedure. This method follows:

1. Weigh crucible and cover.
2. Fill crucible with pieces of apple.

3. Weigh crucible plus cover plus apple.
4. Find the weight of the apple.
5. Heat the crucible plus contents until only ash remains.
6. Cool the crucible and find the weight of crucible plus ash.
7. Determine the weight of the ash.
8. Determine the percent of water in the apple by use of following equation:

$$\% = \frac{\text{Weight of Ash}}{\text{Weight of Apple}} \text{ X } 100$$

This procedure was carried out amid howls of protest throughout the school building when odors of burning apple found their way into neighboring rooms.

But now you say, as your students will also say: "What about the weight of the chemical elements which escaped in the smoke?" To this, we answer; "That gives you an opportunity to inject the idea of 'limitations,' an essential consideration in any scientific experiment."

In the case described here two students worked together as a team. Three apples were cut into pieces so that each team was provided with a portion of apple. The students seemed eager to disprove the experts and were anxious to compare results. The boy who believed that different varieties of apples contain different percentages of water tested his hypothesis during noon hours.

Here is an interesting activity for general science classes. It is an activity which employs materials familiar to the pupil, which demonstrates the experimental method, which uses real experience instead of vicarious experience, which proves that the textbook is not always an infallible source, and which helps to develop that healthy skepticism so essential in today's era of high pressure salesmanship and advertising.

General Science

If You Can't Buy It Wholesale—

By JAMES B. DAVIS, Head of the Science Department, Lower Merion Township High School, Ardmore, Pennsylvania

This is a report of a joint project carried on at Lower Merion High School. A domestic science class cooperated with a general science class in the study of foods. The project could find a place in almost any junior or senior high school.

The problem of economic purchasing of food arose while the unit on foods was being studied by the general science class. Upon invitation the domestic science class agreed to help on the project.

The common food products were purchased in two different quantities. These were weighed, measured, and counted by the pupils, and the following chart was drawn up. It is to be observed that the ten different food products are all easily stored and are not perishable.

The youngsters were delighted with their results, had the chart mimeographed, and each took a copy home. So—if dad could not get it wholesale, he at least found out how to tell mom to buy it cheaper!

Item	Small Pkg.	Cost*	Large Pkg.	Cost	Money Saved	Amount Gained
Flour	2 lbs.	$.25	10 lbs.	$1.03	$.22	Almost 2 lbs.
Tea	16 bags	.19	48 bags	.49	.08	Almost 8 bags
Oatmeal	1 lb.	.17	3 lbs.	.37	.14	Almost 1 lb.
Velveeta	½ lb.	.35	1 lb.	.59	.11	Almost 3 oz.
V-8	12 oz.	.13	46 oz.	.39	.11	Almost 12 oz.
Mayonnaise	½ pt.	.26	1 pt.	.45	.07	¼ cup
Vinegar	1 pt.	.13	1 qt.	.20	.06	½ pt.
Vanilla	1 oz.	.15	4 oz.	.49	.11	Over ½ oz.
Shortening	1 lb.	.35	3 lbs.	.99	.06	Approx. 3 oz.
Peaches (sliced)	1 lb. 1 oz. (2 cups)	.22	1 lb. 13 oz. (3½ cups)	.34	.05	Approx. ½ cup
TOTALS on 10 items		$2.20		$5.34	$1.01	

* All prices as of January 2, 1952.

Chemistry

Nitrogen Trioxide

By DON DRONE, Chemistry Student, Springfield High School, Springfield, Illinois

Instructor's Note: *The project described below grew out of a class discussion and illustrates how interesting student projects can develop from theoretical chemistry as well as from those things of a more practical nature, such as making a candle or shoe polish!* Carrol C. Hall, Springfield High School.

Nitrogen trioxide has an interesting history and a very colorful personality, yet most chemistry students are not acquainted with this rather unusual compound. There are many who have never heard of this somewhat elusive substance and very few who have seen it. The reason for this situation is obvious enough: most chemistry texts say little or nothing about it. Since the compound has no great commercial or chemical value, such books seldom mention it.

Even sources of higher information are a little hazy when it comes to nitrogen trioxide, at times even differing in basic information as to its properties. Perhaps the best source of facts is a good encyclopedia. Here the chances are good that you will learn that its history is closely connected with another colorful and infrequently mentioned chemical character, Johann Glauber, who is remembered by the salt which bears his name. Glauber was a German semi-alchemist who lived in the 17th century. He discovered sodium sulfate, or Glauber's Salts, and traveled most of the European continent with his medieval Hadacol. Aside from this, however, he did do much research. One of the products of this research was nitrogen trioxide. Today we can follow his method of producing the compound and thereby investigate its possibilities.

Essentially the Glauber process consists in distilling nitric acid with arsenic trioxide and then cooling the vapors thus formed in a freezing mixture. The resulting product is a deep blue liquid, a solution of nitrogen trioxide in the water which is also a product of the following reaction:

$$2HNO_3 + As_2O_3 \rightarrow N_2O_3 + As_2O_5 + H_2O$$

The water can be eliminated if the pure liquid is desired by drying the vapors in a calcium cloride tube before condensing them. However the water is a very essential product in the reaction; if it were not formed, reaction would not go to completion, but it would remain in equilibrium.

An analysis of the equation reveals that it is a good example of an oxidation-reduction reaction or electron transfer which is apparent from the valence changes. Consider arsenic. In the trioxide it has a valence of positive three. On the right side of the arrow it shows a valence of positive five, an increase in positive valence due to the loss of two electrons in the combining ring. On the other hand, nitrogen loses in positive valence from five to three, owing to a gain of two electrons. Thus valence gained equals valence lost, or, electrons gained equals electrons lost.

While Glauber used a freezing mixture to condense the trioxide vapors, dry ice is more modern and more efficient. Also the extreme temperatures it reaches allows for observing the stability of the product. As stated above, at freezing temperatures nitrogen trioxide is a blue liquid. If, however, the dry ice is used, it will form as a solid, also blue in color. Upon allowing the material to warm up it will first melt and at considerably below room temperature begin to decompose. This makes it unsafe to keep the compound in a closed vessel without some means for maintaining a lower-than-room temperature.

This decomposition is interesting to watch. When it begins, if done in a closed test tube, a brown gas forms at the top of the tube. Upon breaking down, the trioxide forms the oxide and dioxide of nitrogen. The latter is the brown gas seen in the tube. On paper the reaction looks this way:

$$N_2O_3 \rightarrow NO + NO_2$$

Again the idea of electron transfer is shown. In forming NO, nitrogen loses one unit of positive valence and gains one electron. In the case of the dioxide, there is a gain of valence and a loss of one electron. Thus again, valence and electrons gained is equal to valence or electrons lost. If this reaction is allowed to occur in the open air, the NO readily unites with oxygen to form the dioxide, the reaction goes to completion, and the nitrogen trioxide is lost. If, however, the supply of oxygen is limited, the reaction can be caused to reverse itself by again lowering the temperature. This can be done by placing a piece of dry ice against the side of the tube. On the wall of the tube will appear a dark blue spot indicating that the nitrogen trioxide is being formed.

As yet no important commercial or chemical use has been suggested for nitrogen trioxide. There is a slight possibility that it may have some importance as a disinfectant, but this is rather uncertain. Even if it never achieves commercial significance, it does serve to illustrate well several important and basic

chemical ideas as well as to provide us with an interesting laboratory curiosity.

Physics

Measuring the Resistance of Wires

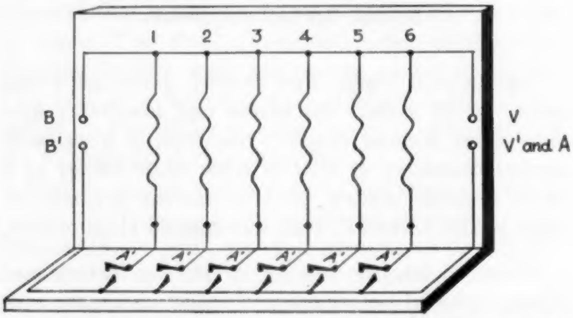
By MARTIN BURGER, William E. Grady Vocational High School, Brooklyn, New York

The accompanying diagram of a demonstration set-up has been found very useful for studying the resistance of wires whose chemical make-up and lengths are the same but whose cross-sectional areas are different.

To obtain the resistance of each wire measure the voltage and current flow through the wire and then calculate the resistance by substituting the observed values in the Ohm's law equation.

A 1½-volt dry cell battery may be used as the source of electrical energy, and a Welch 2692 demonstration meter to measure the voltage and amperage flowing through each wire.

In the diagram, B and B′ are the battery connections. V and V′ are the voltmeter connections. A is the common lead for one side of the ammeter, and A′ is the lead which goes from the swivel section of each of the single-pole, single-throw knife switches to the other terminal of the ammeter. The amperage is measured across the appropriate open switch for each of the wires.



A demonstration set-up found useful for studying the resistance of wires whose chemical make-up and lengths are the same but whose cross-sectional areas are different.

In the set-up wires 1, 3, and 5 are B & S #10 gauge, and wires 2, 4, and 6 are B & S #26 gauge. Wires 1 and 2 are copper, wires 3 and 4 are nichrome, and wires 5 and 6 are iron.

Just one note of caution: An appropriate shunt is required across the ammeter terminals to prevent damage to the Welch meter.

NSTA Activities

▸ *Program* for Summer Conference at University of Michigan

Although the committee to plan the NSTA Annual Summer Conference for 1952 still has much work ahead, enough details are now available to indicate clearly the rich and varied offerings in store for the 300 or more attendants expected to convene at Ann Arbor during June 26-28.

The kickoff on Thursday the 26th will be another in the long list of conferences on industry-science teaching relations. Representatives of industry and of science teaching will discuss sponsored aids for teaching science, including traveling assembly programs, TV programs, booklets and charts, filmstrips, and other media. Full audience participation in the discussion will be encouraged. This will be a full-day conference with a luncheon recess.

After dinner on Thursday there will be a mixer and social hour. This is being arranged by a committee from the Detroit Biology Club.

Sessions on Friday will be devoted to consideration of outstandingly important current problems in science teaching. After provocative presentations of the problems by leaders in science education, all conferees will convene in working groups for discussion of the proposals, exchange of ideas and experiences, and the drawing up of recommendations. The work groups will continue into the afternoon following lunch.

Luncheon on Friday will provide for seating by subject-matter interest groups. This will give chemistry teachers a chance to get together and come to know each other—and for each one to find out how much better every other fellow's teaching situation is than his own; and so for teachers of elementary science, general science, biology, and physics. (Supervisors, college professors, and other forms of "brass" will be forced to descend to the level of classroom teachers and sit and eat at the subject-matter tables.)

At the dinner session Friday evening, Harlan Hatcher, president of the University of Michigan, will be honored guest and will address the conference group. A science speaker or a science panel will complete the bill of fare for that evening.

A "sure-fire" hit will be on tap Saturday morning when five or six classroom science teachers of national repute will explain "Here's How I Do It." They will demonstrate and discuss teaching ideas, gadgets, and techniques that they have found to be effective.

An extended luncheon hour on Saturday will give everyone an opportunity to hear "Reports From Inside NSTA" by a number of officers and committee chairmen. Included are reports on the study of teaching facilities for science in elementary and secondary schools and the program for the Future Scientists of America Foundation. The latter is now developing as a project conducted by NSTA in cooperation with endorsing and sponsoring groups.

The conference will conclude with brief reports of the discussion groups given by the group leaders following lunch. Soon after the conference a full summary report of proceedings will be sent to all registrants. It will be offered to others at a cost of $1.00.

A commercial exhibit of materials for teaching science will be one of the conference highlights. Displays of textbooks, laboratory equipment, and supplementary aids will be provided by 17 commercial firms. *Time to visit the exhibits has been blocked into the conference schedule.*

The conference will provide opportunity for invaluable contacts and opportunities to meet science teachers and leaders in science education from all parts of the country. And, of course, those attending this NSTA conference will already "be there" for the NEA Delegate Assembly which commences June 29 in Detroit. For a good many other persons it is important to mention again that Ann Arbor is right at the edge of thousands of square miles of the best bass, pike, and pan fish lakes in the country. This country is also the best there is for a study of the effects of glaciation and of the geological history of the Great Lakes.

The NSTA Board of Directors will meet in annual business session on June 24-25. For workshop opportunities in connection with the conference please read the next section of *NSTA Activities*. With all these opportunities available, and with board and room in a university dormitory available at only $5 a day, NSTA members simply can't afford to miss the 1952 summer conference.

Workshop for Summer Conference Ready To Go

Only the students remain to be enrolled. Otherwise planning is practically complete for the *Workshop in the Teaching of Science in Elementary and Secondary Schools* to be conducted June 23 to July 3 by the University of Michigan in cooperation with NSTA.

The workshop course is designed to provide opportunities to both undergraduate and graduate students for broadening and deepening their scientific backgrounds and for studying their individual problems in the teaching of science. Special emphasis will be placed on practical applications of the various experiences and activities to classroom situations. The following are some of the Workshop activities.


Photo by Shelburne
Francis D. Curtis

Demonstrations of effective classroom skills and techniques.

Work on individual projects with supervision and assistance provided by the workshop staff.

Lectures by scientists on current developments on the frontiers of research and developments. The lectures will be discussed and interpreted with a view to the incorporation of the material in school science programs.

Field trips to nearby institutions and industries and other field opportunities.

Instruction in visual aids will deal with the uses of various types of visual aids.

Coordinators for the workshop are Francis D. Curtis of the University of Michigan and George G. Millinson of Western Michigan College of Education. E. Eugene Irish of Ball State Teachers College (Muncie, Indiana) and Lawrence Conrey of the University of Michigan will serve as consultants.

The University of Michigan will allow two semester hours of graduate or undergraduate credit for the workshop. The fee for enrollment is $30.00, which includes the advance registration fee of $5.00. Residents of Michigan may enroll for the minimum Summer Session fee of $20.00. To obtain further information and to complete the advance registration, write to the Director of the Summer Session, 3510 University Administration Building, Ann Arbor.

More details and an enrollment form are contained in a descriptive folder soon to be mailed to all NSTA members.

Bulletin for Secondary School Principals Shaping Up

Under the chairmanship of Robert Stollberg of San Francisco State College, rapid progress is being made in lining up contributors of articles for the special "Science Teaching in Secondary Schools" issue of the *Bulletin* of the National Association of Secondary School Principals. Other members of the NSTA committee responsible for the project are Greta Oppe, Ball High School, Galveston, Texas; Paul Brandwein, Forest Hills High School, Forest Hills, New York; Earl Glenn, State Teachers College, Upper Montclair, New Jersey; and Fred Eiseman, Jr., John Burroughs School, Clayton, Missouri.

Planned as the best substitute for "sitting down around the table and talking things over," the *Bulletin* should go far in bringing high school principals and their science teachers into better understanding regarding a number of urgent, even critical, problems of science teaching. Publication is scheduled for the January, 1953, issue of the *Bulletin*. A few additional copies will be made available for NSTA distribution at low cost.

Film Excerpts Committee Has Big Project Under Way

Seeing occasional movies is one thing; but reading film analysis charts for *all Hollywood films produced during the past ten years*—that is something else again. But it's just what Ernie Snyder, graduate student in science education at New York University, has done for the NSTA Film Excerpts Committee. After he detects some "science teaching potential" in one of the film analysis charts, he next reads the entire script for the film. Films that do seem promising are then reviewed and discussed by the entire committee.

The accompanying photograph shows the committee during a work session. From left to right, the members are John Read, Boston University; J. Darrell Barnard, *chairman*, New York University; Robert H. Carleton, *ex officio*, NSTA executive secretary; Ernest Snyder, New York University; N. Eldred Bingham, University of Florida; and Hubert Evans, Teachers College, Columbia University.

The committee now has one film in the early stages of excerpting and at its next session the end of April will preview six additional films. Once a film has definitely been accepted for excerpting, the working group for that film will be expanded through enlisting a number of classroom science teachers to serve as consultants to the committee. All expenses of the entire film excerpting project are borne by the Motion Picture Association of America and Teaching Films Custodians.

Business-Industry Section Meetings Held With AASA

Meetings of the NSTA Business-Industry Section were scheduled for each of the regional meetings of the American Association of School Administrators. Brief reports of the St. Louis and Los Angeles meetings are given below, but the Boston meeting of the B-I Section and also the Advisory Council on Industry-Science Teaching Relations will occur April 7-8 after we have gone to press.

The St. Louis meeting was held February 25 in Kiel Auditorium. About 50 persons attended. Chairman Inez M. DeVille of the B. and O. Railroad, Baltimore, explained the general purposes of the meeting and introduced W. Henry Galbreth of the Iowa State Education Association, Des Moines, who spoke from the educational point of view. Ray O. Mertes, United Airlines, Chicago, presented

views on the importance of business-industry co-operation with schools.

The Los Angeles meeting was held March 10 in the Biltmore Hotel, attended by some 45 educators and representatives of major industries on the Pacific Coast. Addresses were made by John R. Given, director of Metropolitan Junior College of California; M. Edmund Speare, educational director of the National Coal Association; and Raymond Hayes, local representative of General Motors Corporation. A profitable discussion followed thereafter in which many educators and industry-representatives in the audience participated. G. P. O'Connell, public relations department, General Motors, Detroit, presided. Mr. Given discussed convincingly out of his own experiences the importance of furthering business-industry-education relations. Dr. Speare discussed the value of bringing educators and industry representatives together in local areas regularly and made an appeal for educators and industrialists to take the offensive in making the youth of America aware of what is meant by the free enterprise system and the American way of life. Mr. Hayes demonstrated, from the free instructional literature issued by General Motors, what his corporation is doing to help teachers and students in the classroom.

Changes in NSTA Magazine Staff Announced

Mary Ellen Brain, managing editor of *The Science Teacher* the past two years, resigned from our staff on April 4 due to the requirements of pending maternity. Speaking for all the membership, we greatly appreciate the high quality of her services in guiding our journal to its present professional peak. The handling of all advertising, both its promotion and the layout, has been in her hands. The format and design of the journal are entirely her work. Her duties with NSTA have included many diverse assignments hardly in the category of managing editor of a magazine. It has been a great pleasure and help to me personally to have had the benefit of her assistance. This is to express my appreciation to Mary Ellen and to wish her and Bill Brain happiness and good fortune in the new duties about to descend upon them.

In consequence of the above, on March 17 Miss Connie Conneran joined our staff as editorial assistant. She came to us from Young America Publications, Silver Spring, Maryland. Prior to going with Young America two years ago, Miss Conneran had been a member of the *NEA Journal* staff for five years; and before that she was an elementary teacher in her home state of Minnesota. I am looking forward to having Miss Conneran work with us not only on *The Science Teacher* but in connection with all NSTA publications, including the new *Elementary Science News*.

Elementary Science News will be a four- or eight-page publication of notebook size and issued at least quarterly. It will be produced by our staff but editorially will be in the hands of the NSTA Committee on Elementary Science. In connection with the new publication, efforts will be stepped up to enroll elementary schools on a subscription basis to receive the magazine, packets, and the like. In addition, *Elementary Science News* will be sent to each school in sufficient quantity to provide a copy for each individual teacher in the school. School subscriptions are $5.00 a year. Subscribers will be entered for one year from date of entry. Whatever you can do NOW to bring this opportunity to the attention of those responsible for elementary education in your system will be a service to them and will be appreciated by NSTA.

ROBERT H. CARLETON
NSTA Executive Secretary

Members of the Hi-Sci Club of Northwestern High School, Hyattsville, Maryland, assemble Packet XIX for NSTA. Thirty-eight members participated during three after-school sessions for an average of two hours work per member. Approximately 7500 packets each containing ten items were completed in 131 man-hours. Remuneration received from NSTA for this packaging project was used by the club to finance its First Annual Science Fair and Congress held on March 22. Club treasurer James Conley (standing beside the posterior end of the skeleton in the rear of the room) directed the project. The club is jointly sponsored by John Palmer (shown talking to one of the girls at the first table) and Howard B. Owens (wearing the white coat).

Nominations Committee Report and Ballot for Officers—1952

The 1952 Committee on Nominations herewith submits its slate for the offices of president-elect, secretary, treasurer, two regional vice-presidents, two regional directors, and two directors-at-large. As provided in the constitution the term of office will be one year for president-elect, secretary, and treasurer; two years for regional vice-presidents and regional directors; and three years for directors-at-large.

At a meeting of the committee in Philadelphia on December 27, the procedures to be followed in making up the slate were decided upon. It was agreed to invite all members of NSTA to suggest nominations for the various offices. This was done by announcement in *The Science Teacher,* by letters, and by personal contacts by members of the committee. The transactions of the committee consisted of about 300 letters, telephone calls, and telegrams. The response of the members of the association in submitting names was excellent. About 500 nominations were received. The committee tabulated these and then considered the qualifications and records of the people named in the light of their experience, field of interest, teaching level, and geographical distribution.

At Mills College in July, 1951, the Board of Directors decided to leave the matter of submitting one or more names for an office to the discretion of the Nominations Committee. In accordance with this policy this committee is making only one nomination for all offices except for directors-at-large. Since about 175 nominations were received for directors-at-large, six names are submitted for these offices, of which two are to be elected.

As in most professional societies the members of NSTA do not usually seek office. If elected, they serve as a matter of professional interest and responsibility. On the other hand, some members best qualified for office-holding hesitate or even refuse to run if they know that certain other members are running for the same office. At least this has been the experience of previous nominating committees. As a precedent for selecting a single name for the major offices, we may mention that this is the practice of the American Association of University Professors and numerous other professional groups.

It is obvious that the officers of a professional association should be of high standing in their field and in sympathy with the principles and purposes of the society they represent. This committee acted with these ideas in mind and believes that it has selected the slate which best represents the composite opinion of the organization. All nominees have agreed to serve if elected. The committee expresses its appreciation to the members of the association who suggested nominations. Our special thanks go to President Arthur O. Baker and Executive Secretary Robert H. Carleton. These officers promptly answered our many questions concerning the records and qualifications of nominees.

The slate is as follows:*

For *President-Elect*—Charlotte Grant
For *Secretary*—Zachariah Subarsky
For *Treasurer*—H. E. Brown
For *Regional Vice-President* (North Central) —Dean Stroud
For *Regional Vice-President* (Southern) — Greta Oppe
For *Regional Director* (North Central)—John E. Habat, Jr.
For *Regional Director* (Southern)—Mrs. M. Gordon Brown
For *Directors-At-Large* (two to be elected)—
Blanche G. Bobbitt
William Goins
Florence Learzaf
Brother Thomas P. Schick
Wayne Taylor
Fletcher Watson

Respectfully submitted,

Walter S. Lapp, Chairman, Philadelphia, Pennsylvania
Marjorie Campbell, Washington, D. C.
Arthur S. Houston, Keene, New Hampshire
J. H. Jensen, Aberdeen, South Dakota
Louise Lyons, Steubenville, Ohio
S. Ralph Powers, New York, New York

Ballot for Election of Officers—1952

(Note: Vote for one *person only for all offices except directors-at-large. Vote for* two *directors-at-large. Spaces have been provided for write-in votes for all offices except president and retiring president, both of which are provided for by constitutional ascendency of the incumbent president-elect*

* Biographical information on each of the nominees is given on the next page. Nominees are listed alphabetically.

and president. After marking your ballot, mail it to Miss Louise Lyons, Steubenville High School, Steubenville, Ohio. *To be counted, ballots must be post-marked not later than May 10, 1952.)*

For President:
HAROLD E. WISE

For Retiring President:
ARTHUR O. BAKER

For President-Elect:
........CHARLOTTE L. GRANT (write-in)..............................

For Secretary:
........ZACHARIAH SUBARSKY (write-in)..............................

For Treasurer:
........HUGH E. BROWN (write-in)..............................

For Regional Vice President, North Central:
........DEAN STROUD (write-in)..............................

For Regional Vice-President, Southern:
........GRETA OPPE (write-in)..............................

For Regional Director, North Central:
........JOHN E. HABAT, JR. (write-in)..............................

For Regional Director, Southern:
........MRS. M. GORDON BROWN (write-in)..............................

For Directors-at-Large:
........BLANCHE G. BOBBITT ....WAYNE TAYLOR
........WILLIAM GOINS, JR. ....FLETCHER WATSON
........FLORENCE LEARZAF (write-in)..............................
........BROTHER THOMAS P. SCHICK (write-in)..............................

Biographical Information on Nominees

Blanche Bobbitt is supervisor of science, mathematics, and health coordination in the Los Angeles City schools, prior to which she was an instructor in chemistry in the University of Southern California. She holds A. B., M. S., and Ph. D. degrees from that institution, the Ph. D. being from the School of Medicine. She is Sigma Xi and Phi Beta Kappa. She has done research in biochemistry and reported her work through such journals as the *American Journal of Physiology* and the *Journal of Biological Chemistry;* her articles on science education number a dozen or more, especially in fields of UNESCO relations, civil defense, atomic energy, and programs for gifted pupils in science. She is a member of the California Science Teachers Association (Southern Section) and has held several offices in the American Chemical Society, Pacific Southwest Section. She has been chairman of the NSTA Committee on International Relations since 1949.

Hugh Brown is editor of educational charts for the W. M. Welch Scientific Company. He was a high school science teacher prior to his present position. His degrees, A. B. and A. M., are from Indiana University. He is Phi Beta Kappa and Sigma Xi. He has served as treasurer during the past year and as a member of the NSTA Executive Committee.

Mrs. M. Gordon Brown is science coordinator for the high schools of Atlanta, Georgia. Prior to taking up her present post three years ago she was teacher of chemistry and human biology in Atlanta. She has a B. S. degree from Radford Teachers College and an M. S. from Emory University; has done other graduate work at Columbia University. She is a member of Phi Sigma and the National Association for Research in Science Teaching; was a member of the first Thomas A. Edison Foundation Institute for Science Teachers. She has published works in the fields of history and biology and is currently revising *The Human Body* by Best and Taylor.

William F. Goins, Jr. is professor and head of the department of science education, Tennessee A. and I. University, Nashville. He has the B. S. degree from Hampton Institute and the M. A. and Ph. D. degrees from Ohio State University. He has served as science instructor in the Dunbar High School, Lynchburg, Virginia, and as assistant professor of chemistry in Hampton Institute. He was a General Education Board Fellow in 1948. He is a member of the American Association of University Professors, Phi Delta Kappa, and the Tennessee Academy of Science; has served on the NSTA committee on Facilities for Science Instruction in Elementary and Secondary Schools.

Charlotte L. Grant is dean of the junior class and instructor in biological sciences, Oak Park and River Forest High School, Oak Park, Illinois. She holds the A. B. degree from DePauw University and the M. A. and Ph. D. degrees from the University of Illinois; is Sigma Xi and Phi Beta Kappa and a Fellow of the AAAS. She has served on the NSTA Board of Directors since 1947; is a member of the Magazine Advisory Board and of the committees on professional relations and projects and health science. In 1949 she was president of the Central Association of Science and Mathematics Teachers; is a member of the National Association for Research in Science Teaching and the National Association of Biology Teachers.

John E. Habat teaches eighth-grade general science in the Shore School, Euclid, Ohio, and serves as adviser and coach for the school's Health Science Club. He holds the degree of B. S. Ed. from Ohio University. He served as chairman of the exhibits committee for the Cleveland meeting of NSTA in December 1950; is currently a member of the Board of Directors of the Central Association of Science and Mathematics Teachers, and edits *News and Views* for the Cleveland Regional Association of Science Teachers.

Florence Learzaf is principal of the Horace Mann and John Morrow elementary schools in Pittsburgh. Formerly she was a teacher in the elementary schools of this city and later a supervisor with special reponsibility for science in the elementary schools. She has the B. S. and M. Ed. degrees from the University of Pittsburgh. She was a member of the First TAEF Institute for Science Teachers and has served as a consultant from the elementary grades on the development of sponsored teaching aids.

Greta Oppe teaches chemistry and is head of the science department in Ball High School, Galveston, Texas. She has a B. A. degree from the University of Texas and an M. A. from New York University. She is a Fellow of the AAAS and also of the Texas Academy of Science; is a Life Member of both NSTA and NEA. She is the NEA representative to the AAAS Council. She has published a work-text in chemistry and has contributed numerous articles to a variety of magazines. She has served as NSTA southern regional vice-president since 1944; is a member of the NSTA committees on special bulletins and science achievement awards.

Brother Thomas P. Schick, S. M., is vice-principal and instructor in physics in North Catholic High School, Pittsburgh, Pennsylvania. He has a B. S. Ed. degree from the University of Dayton and an M. S. from the Catholic University of America; has done other graduate work at the University of Pittsburgh. He taught science and mathematics for seven years in Hankow, China.

Dean Stroud teaches general science and is head of the science department in the Amos Hiatt school, Des Moines, Iowa. He was a member of the committee to write the Iowa course of study in general science. He has the A. B. degree from Des Moines University and the M. A. from the University of Iowa. He has been NSTA co-state director for Iowa since 1944 and served as North Central regional vice-president during the past year. This past January he was a member of the NSTA "team" at the Workshop held at Staff College of the Federal Civil Defense Administration, Olney, Maryland. He is president of the Des Moines Classroom Teachers Association.

Zachariah Subarsky is chairman of the department of biology and general science in the Bronx High School of Science, New York City. His B. S. degree is from the College of the City of New York and his M. S. from Columbia University. He is a Fellow of the AAAS and a past president of the Federation of Science Teacher Associations of New York City. He has served four years on the NSTA Advisory Council on Industry-Science Teaching Relations and on other committees. He is a director of a Science Week-end Camp and a lecturer for the National Conference of Christians and Jews.

Wayne Taylor is head of the science department, Denton Senior High School, Denton, Texas. He has been an instructor in physics at North Texas State College and in electrical engineering at Texas A. and M. College. His degrees, B. S. and M. S., are from North Texas State College. He is a Fellow of the Texas Academy of Science and of AAAS; is a member of Phi Delta Kappa. He was a Westinghouse Fellow at M. I. T. the summer of 1951. He has served on the NSTA committees on evaluation of sponsored teaching materials and apparatus and equipment. He is president of the Texas Association of Science Teachers.

Fletcher G. Watson is associate professor of education, Harvard University. He was formerly research associate and executive secretary of the Harvard College Observatory. His A. B. degree is from Pomona College, his M. A. and Ph. D. from Harvard. He is Sigma Xi and Phi Beta Kappa and has a commendation from the Secretary of the Navy. He is author of *Between the Planets* and numerous articles on astronomical research and science education. He is executive director of the New England School Science Council.

BOOKS Review

Miss Pickerell Goes to Mars. Ellen MacGregor. 128 pp. $2.25. Whittlesey House. New York. 1951.

With this fast-moving story Ellen MacGregor has filled a long-standing need for science fiction divorced from the stereotyped patterns of the comics. In this adventure of a maiden aunt who inadvertently is included in a trip to Mars the author manages to work in a goodly mixture of scientific knowledge and theory. Mr. Galdone's illustrations are a happy addition to reader interest.

The story is aimed at the eight-to-twelve-year-old level. However, since there is nothing in the book to identify this age group, it might be extremely valuable for use with children up to 14 with low reading achievement. As a gift for a child with an inquiring mind, as a motivating force in a science class, or as a text for the remedial reading class, *Miss Pickerell Goes To Mars* is a worthwhile contribution to present-day children's fiction.

Teresa M. Powers
Hine Junior High School
Washington, D. C.

Resource Guide for General Biological Science. Community High Schools. $1.00. Atlanta, Georgia. September, 1951.

This resource guide is the result of the combined efforts of the teachers and supervisors of the Atlanta school system with the assistance of consultants. It is a tremendous piece of work and has been conscientiously prepared. There are eight units, each of which, according to the introduction, is presented in problem-principle form. The units are as follows: I. What Are the Differences Between Living and Non-Living Things? II. How Are Plants and Animals Sorted Into Groups? III. What Is Food? IV. How Are Foods Used? V. Why Do Living Things Behave As They Do? VI. How Does Life Continue? VII. Why Are Living Things Like Their Relatives? VIII. How Does Biology Improve and Enrich Our Lives?

Within each unit, suggestions are offered under these headings (presented on consecutive pages): —approach activities, introductory questions, demonstrations and individual experiments, readings, audio-visual aids, guides to conclusions, application questions, and projects. A remarkable number of references obviously have been investigated. It is further recognized that all the material cannot be taught in one year. Thus the teacher is given freedom to teach and the responsibility to select the material which meets the needs and interests of the children, the school, and the community.

There are several heartening advances to be found in this course of study. The presentation of the material as a resource guide rather than as an inflexible syllabus with specific subject matter to be covered, supports a philosophy of science education which looks to the interests and differences in abilities of individual classes of students. Suggested science activities are of varying grades of difficulty to provide wide experiences for students of different abilities. The knowledge that all the material suggested in the course of study cannot be taught to one class should encourage a more leisurely teaching tempo with less strain on the teacher; it should provide opportunities to discover abilities, interests, and special needs of individual students. Many studies have shown that more effective learning occurs where favorable teacher-student relationships are formed and where there is a permissive attitude with absence of threat that material must be covered regardless of interest and understanding.

The organization of this course of study also gives teachers the opportunity to plan with youngsters the fulfillment of the most desirable objectives set up in the introduction to the resource guide. Teachers and students can raise broad prob-

lems expressed in terms of "how" and "why" and thereby consolidate into meaningful problems (and reach broad, unified generalizations) many of the topics which are included in the resource guide as "what" type of questions.

It is notable to find many attempts to bring the subject material within the range of students' experiences. However, it must be suggested that personification of facts in science (e.g., "Mr. H_2O marries Miss CO_2," etc.) blur the significance of the nature of scientific phenomena. However, the attempts to do this are important and as an initial trial they are significant.

It may also be true that when students are given a share of responsibility for their own learning they will raise those problems which concern them, i.e., functions of the body, behavior (including narcotics), and heredity (including reproduction). It is likely students will want to start with human behavior rather than tropisms, an approach suggested in the course of study. Adolescents want to know more about themselves and why others behave as they do.

Those topics in the resource guide which show persistent college influence, e.g., technical classification, earthworm circulation, evolution of digestive systems, etc., will probably not be problems raised by adolescents nor may they be significant to them. It is general experience that when students deal with significant topics they will read beyond the pages of their texts and will read more widely in many reference texts and pamphlets.

The unit on heredity is particularly well planned and presents an approach with stress on human problems rather than Mendelism in its stark sense, e.g., peas, not human beings. The unit truly reflects the questions most often asked by youngsters. Class activities develop from a discussion of students' traits and begin at the students' level. Evidence from human genetics follows with a study of Mendel's work. This approach might have been profitably followed throughout.

In summary, the guide generally provides ample opportunities to develop student-centered experiences rather than a subject-centered syllabus. The choice depends on the teacher.

EVELYN MORHOLT and
PAUL F. BRANDWEIN
Forest Hills High School
Forest Hills, New York

Books and Pamphlets Received

Your Opportunities in Science. National Association of Manufacturers. 14 West 49th Street, New York 20. 30 pp. 1952. Free. Provides a wealth of practical information on science and engineering and specific jobs within these fields. Brevity, provocative illustrations, and ease of readability are among its good features. Brief case studies will attract student attention. Chapter titles are as follows: I. Your New Frontiers in Science. II. Where Would You Fit in Science? III. Would You Be a Success in Science? IV. Develop Your "Success Qualities." A final section is titled, Scientists Shape the Future! Educational consultants participated in development of the booklet.

Shall I study Geological Science? American Geological Institute. 2101 Constitution Avenue, Washington 25, D. C. 8 pp. 1952. Free. Just the kind of informational booklet science-career-minded students in high schools will be able to read with profit and enjoyment. In brief, down-to-the-student language, the booklet answers questions such as: Where Do Geological Scientists Work? What Kind of Training? How Will I Secure Employment? Would I Make Good in Geological Science?

Combatting Prejudice Through Science Teaching. R. Will Burnett. 32 pp. $1.00 National Science Teachers Association. Washington, D. C. 1952. This monograph is Volume VIII in the *Science Teaching Today* series of NSTA. The author, who is professor of science education in the University of Illinois, points out in the Introduction: "A prejudice is a sub-intellectual development in the human personality . . . it is always unreasoned. . . . There is some evidence, however, that a significant contribution can be made to the lessening of racial prejudice through science teaching. . . . The present booklet is a thumbnail sketch of suggestions that teachers of science might find useful and that are directly within the field of science as such. The suggestions are particularly pertinent to teachers of biology and general science. Because reference materials may often be inaccessible, the activities suggested include sufficient information for the teacher to enable him to carry them out even though his background in anthropology and genetics and his experience in inter-cultural relations teaching may be limited."

These "coupon service" pages announce the availability of free and low-cost teaching aids for science. Those that are business-sponsored have been reviewed by the NSTA Evaluation Committee and approved for distribution by the Association. To procure copies of desired items, fill out the corresponding coupons and mail these, together with any remittance required, to the NSTA Executive Secretary, 1201 Sixteenth Street, N.W., Washington 6. Watch these columns for additional offerings in future issues of *The Science Teacher.* (Print or type coupons.)

ROMANTIC COPPER. *Copper and Brass Research Association.* Informational booklet suited to use in general science and chemistry for enrichment purposes. Deals with history and metallurgy of copper. Free.

THE EDISON EFFECT—THE BEGINNING OF ELECTRONICS. *Thomas Alva Edison Foundation.* Second in a series of booklets describing Mr. Edison's principal inventions. The first, *The Incandescent Light,* was distributed in NSTA Packet XII. Authentic and very readable, beautifully illustrated. This booklet is informational for teachers and useful to students of junior high school age and older. Foreword by Charles F. Kettering. 72 pages; 50 cents.

Please send me .... free copies of **Romantic Copper.**

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SCIENCE TEACHERS' GUIDE FOR WOOD EXPERIMENTS. *Timber Engineering Company.* Instructions and study questions for 18 experiments with wood. Useful for group activities and for special projects. Suitable for general science, biology, chemistry, and physics. Prepared in consultation with NSTA. Fifty cents a copy. (*Wood Study Kits,* including wood samples, manual, and special magnifying lens, $8.50.)

WHAT THE IDEAL CHEMISTRY COURSE SHOULD BE. *National Science Teachers Association.* Reprint of the popular article by Elbert C. Weaver which appeared in the November, 1951, issue of *The Science Teacher.* Provides numerous instructional suggestions. 20 cents a copy.

Please send me .... copies of **The Edison Effect at 50¢ each.** (Remittance enclosed.)

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Post Office.......... Zone.......... State..........

Please send me .... copies of **the Science Teachers' Guide for Wood Experiments at 50¢ each. (Remittance enclosed.)**

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OPPORTUNITIES IN ATOMIC ENERGY. *Vocational Guidance Manuals.* Informational book covering all aspects of atomic energy and providing a wealth of vocational guidance information. See review, *The Science Teacher,* October, 1951, page 218. $1.00.

SAFETY THRU ELEMENTARY SCIENCE. *National Education Association.* Designed to help teachers of upper elementary grades make safety an integral part of their science instruction. Suggests scientific principles which can be explained to children in terms of hazards and desirable practices. Areas treated include toys, tools, and machines; electricity; fire; animals; plants. Goes on to give specific teaching suggestions. 40 pages; 50 cents.

SAFE USE OF ELECTRICAL EQUIPMENT. *National Education Association.* Booklet for teachers, laymen, and students. Provides information, teaching suggestions, and quiz. Produced cooperatively by NSTA and National Commission on Safety Education. Special price to NSTA members only, 25 cents (50 cents to non-members).

Please send me .... copies of **What The Ideal Chemistry Course Should Be** at 20¢ each. (Remittance enclosed.)

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Please send me .... copies of **Opportunities in Atomic Energy** at $1.00 each. (Remittance enclosed.)

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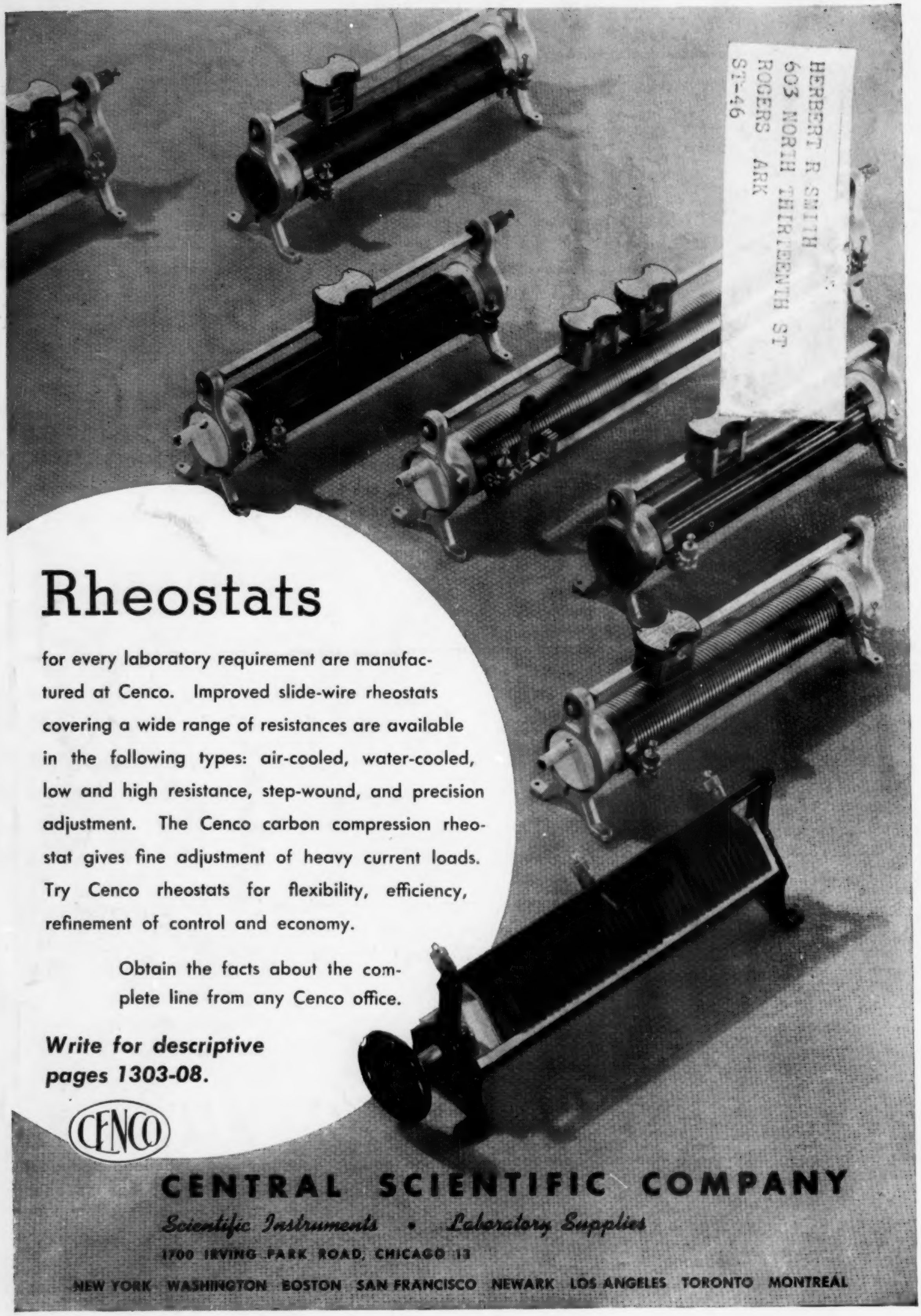
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